HELSINKI SCHOOL OF ECONOMICS (HSE)
Department of Accounting and Finance

# TACTICAL INVESTING IN U.S. REAL ESTATE INVESTMENT TRUSTS

## Momentum Effect and Diversification Benefits



Finance
Master´s thesis
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HELSINKI SCHOOL OF ECONOMICS
Master's Thesis in Finance
Antti Pirskanen

ABSTRACT
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# TACTICAL INVESTING IN U.S. REAL ESTATE INVESTMENT TRUSTS

## OBJECTIVES

The main objective of this thesis is to find evidence from momentum phenomenon in the U.S. Real Estate Investment Trusts and study the practical feasibility of REIT momentum strategies for an institutional investor's point of view. This is carried out by first testing the profitability of 96 momentum strategies without transaction costs. Then, the effect of transaction costs are analysed and finally the average monthly REIT momentum position sizes for an institutional investor is estimated. Also the diversification benefits of REIT long-only and REIT momentum strategies are examined.

In brief, the main contribution of this thesis is that to my best knowledge it's the first study which explicitly test the practical feasibility of REIT momentum strategies. In addition, this thesis extends the momentum literature by analysing several aspects related to the momentum phenomenon, e.g. the Hong et al. (1999) information diffusion theory as a possible explanation for momentum profits. The thesis also tests the Fama and French (1993) three factor model's ability to explain the momentum profits.

## DATA

The core data set consists of 146 REITs which are currently traded in AMEX, NYSE or NASDAQ stock exchanges. They have been first identified and then data has been collected by hand. The REIT-specific information, e.g. financial information and information about the share prices, are collected by using Thomson ONE Banker and Reuters 3000 Extra. The selected time period is 1.1.1995 – 31.12.2007. The sample generates close to 1 400 firm years, this is due to the fact that some of the REITs in the sample have existed only for a few years. The equity and bond index data is collected from DataStream.

## RESULTS

The main result of this thesis is that, strong evidence indicates that momentum phenomenon exist in the REIT market. All of the 96 strategies studied showed positive monthly excess returns when transaction costs are excluded. However, evidence indicates that in practise REIT momentum strategies are not feasible for an institutional investor, i.e. the implementation of transaction costs dramatically reduces the excess returns. In addition, the position size estimation presents evidence that the REIT momentum positions are too small for an institutional investor. Interestingly, the evidence indicates that both the REIT momentum and REIT long-only strategies can provide investors with diversification benefits in mixed-asset portfolio situation.

I also find evidence which supports the Hong et al. (1999) information diffusion theory as a possible explanation of momentum profits, i.e. the momentum returns are bigger during the period in which the speed of information diffusion is slower. In addition, Fama and French (1993) three factor model is unable to explain the excess returns from REIT momentum strategies. Finally, evidence indicates that momentum REITs typically are i) smaller, ii) have smaller institutional ownership, iii) have more leverage and more fluctuating earnings per share (EPS) than REITs on average in the sample.

## KEYWORDS

Momentum, Real Estate Investment Trust, Mixed-asset portfolio

HELSINKI SCHOOL OF ECONOMICS
Rahoituksen Pro Gradu -tutkielma
Antti Pirskanen

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# TACTICAL INVESTING IN U.S. REAL ESTATE INVESTMENT TRUSTS

## TUTKIMUKSEN TARKOITUS

Tutkielman tarkoituksena on tutkia institutionaalisen sijoittajan näkökulmasta momentum-ilmiötä sekä momentum-strategioiden käytännön soveltamisen mahdollisuuksia amerikkalaisissa pörssilistatuissa kiinteistösijoitusyhtiöissä (Real Estate Investment Trust, *REIT*). Tutkimus perustuu 96 momentum-strategian syvälliseen analyysiin, jossa ensin tutkitaan strategioiden kannattavuutta ilman kaupankäyntikuluja ja tämän jälkeen kaupankäyntikulut huomioon ottaen. Lisäksi estimoidaan kuukausittaista *REIT momentum* -position kokoa, jolla institutionaalinen sijoittaja voisi käydä kauppaa hyödyntäessään REIT-momentum -strategiaa. Tämän lisäksi tutkitaan REIT momentum- ja REIT long-only -strategioiden tarjoamia hajautushyötyjä osana laajempaa portfoliota.

Tämä tutkielma kontribuoi aiheeseen siten, että se tutkii nimenomaan REIT momentum -strategioiden käytännön toteuttamismahdollisuuksia. Lisäksi tämä työ laajentaa yleistä momentum-kirjallisuutta mm. testaamalla Hong et al. (1999) informaation diffuusioteorian merkitystä momentum-ilmiön selittäjänä ja Fama & Frenchin (1993) 3-faktorimallin kyvykkyyttä selittää momentum-tuottoja.

## AINEISTO

Aineisto koostuu 146:sta Amexissa, NYSE:ssä tai NASDAQ:ssa noteeratusta REIT:ista. REIT:it on ensin tunnistetty, jonka jälkeen tuottodata on kerätty käsin. REIT:eja koskeva informaatio, kuten osakekurssit, taloudellinen informaatio yms., on kerätty Thomson ONE Banker -ja Reuters 3000 Extra -tietokannoista. Valittu ajanjakso on 1.1.1995–31.12.2007. Osake- ja bondi-indeksidata on kerätty DataStream-tietokannasta.

## TULOKSET

Tutkielman tulokset osoittavat kiistattomasti, että momentum-ilmiö esiintyy REIT-markkinoilla tarkastelujaksolla. Kaikki 96 tutkittua momentum-strategiaa tuottivat kuukausittaisia positiivisia ylituottoja. Tulokset kuitenkin osoittavat, että momentum-strategioiden käytännön soveltaminen on lähes mahdotonta johtuen siitä, että kaupankäyntikustannusten huomioon ottaminen pienentää momentum-tuottoja huomattavasti. Lisäksi momentum-position koon estimoinnin tulosten mukaan mahdolliset REIT-momentum -positiot, joilla sijoittaja voisi käydä kauppaa, ovat liian pieniä institutionaalisille sijoittajille. Tästä huolimatta tulokset osoittavat myös, että REIT-momentum ja REIT long-only -strategiat tarjoavat sijoittajille hajautushyötyjä osana laajempaa portfoliota.

Näiden tulosten lisäksi löytyy tuloksia, jotka tukevat Hong et al. (1999) informaation diffuusioteoriaa mahdollisena momentum-tuottojen selittäjänä. Tällöin momentum-ilmiö on voimakkaampi ajanjaksolla, jolla informaation diffuusio on ollut hitaampaa. Lisäksi tutkimuksessa osoitetaan, ettei Fama & Frenchin (1993) kolmifaktorimalli kykene selittämään momentum-tuottoja. Lopuksi REIT:it, jotka valikoituvat useimmin momentum-portfolioihin ovat i) pienempiä ii) niissä on pienempi institutionaalinen omistus iii) niissä on enemmän velkaa ja vaihtelevampi osakekohtainen tulos (EPS) kuin aineiston REIT:eissa keskimäärin.

## AVAINSANAT

Momentum, Real Estate Investment Trust, Mixed-asset portfolio

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# 1 Introduction

"*Well, real estate is always good, as far as I'm concerned.*"
-Donald Trump, CEO of the Trump Organization

## 1.1 Background and motivation

Real estate is arguably one of the oldest asset classes in the world; according to the famous tale Peter Minuit acquired Manhattan from the native people in the year 1621 in exchange for goods, often said to be worth $24[1]. Nowadays real estate in Manhattan is probably the most expensive in the world. For example, in 2007 an office building located at 450 Park Avenue was sold at $1 566 a square foot breaking the record for the most expensive office building in the United States[2].

The U.S. real estate market has evolved a lot since the days of Mr. Minuit. One of the most influential changes was the forming of legislation which created Real Estate Investment Trusts ("REITs"). These publicly traded vehicles provide an easy and cost efficient way for institutions and individuals to gain exposure to real estate assets. Traditional, unsecuritized real estate demands lots of time and effort from the investor. REITs on the other hand, are well suited for investors as they are traded in stock exchange like any other stock. There has been a huge growth in the U.S. real estate market. According to the Finnish Association for Building Owners and Construction Clients ("Rakli") (2008), the U.S. market is currently estimated to be approximately $5 trillion of which 7% is owned trough stock exchange listed vehicles, i.e. REITs and other types of real estate investment companies.

The Finnish real estate market has seen some major fluctuations during the last twenty years. In the 1990s, the market suffered from big boom and then huge crash, which has the same elements than the current credit crisis related to U.S. subprime mortgages. According to the Statistics Finland Report of Apartment Prices (2007) in the beginning of the 1990s apartment prices were at all time high, then suddenly the housing bubble exploded and prices dropped dramatically. This led to situation where government had to provide emergency financing to the banks in order for them to avoid bankruptcy as many of their clients defaulted on their mortgages. Since then, the real estate market has recovered and especially during the last few

[1] http://www.britannica.com/eb/article-9052900/Peter-Minuit
[2] http://www.nycpropertynews.com/?p=41

years the market has developed rapidly. The Finnish market which has provided good yields with medium risks has attracted many foreign investors. According to the research of Catella Property Group (2008), there are currently over 70 international real estate investors which have investments in the Finnish market. In 2007, the total real estate transaction volume was around €6 billion. The biggest transaction of 2007 was sale of the portfolio consisting of 43 properties by Sponda to Whitehall Street Investment Funds & Niam Nordic Investment Fund 3 for €402 million. The next step in the evolution of the Finnish real estate market is the legislation for REITs. Rakli has lobbied for the REITs for several years already. At the moment Prime Minister Vanhanen's second cabinet has added the residential REIT to the government programme. This legislation would enable investing to rental apartments by using the REIT structure. The goal of Rakli is to further lobby for the REIT legislation, so that there wouldn't be any unnecessary limitations and that REIT structure could be used in all different kinds of real estate investments in Finland.

Typically real estate investments have been viewed as in between stocks and bonds, i.e. not as risky as stocks but still providing better returns than bonds[3]. However, there are times when REITs for example have delivered returns superior to the S&P 500 index. For example, according to the National Association of Real Estate Investment Trust ("NAREIT") chart book (2007) the FTSE REIT index beat S&P 500 in six out of seven years during 2000-2007. Another important attribute of real estate investments is the potential diversification benefit it offers in mixed-asset portfolio situation. For example, Lee et al. (2005) and Hsuan-Chi et al. (2005) find that REITs improve investor's mean-variance frontier, thus enhance the portfolio's performance. REITs are also characterised by high dividend yield; according to the REIT legislation, REITs have to distribute 90 % of their earnings out as dividends. NAREIT research report (2000) indicates that during 1990 – 2000, average dividend yield of REITs was 2.37 percentage points above the yield on 10-year treasury securities, thus REITs provide investors with steady and strong cash flow. The current REIT literature has not studied the tactical investing, i.e. momentum strategies and their diversification benefits in detail. This thesis aims at studying the feasibility of REIT momentum strategies and presenting evidence of the true profitability of REIT momentum strategies.

[3] See e.g. Lee and Stevenson (2005)

Master's thesis provides an excellent platform to study several interesting topics related to the tactical investing in REITs. I'm able to cover topics such as studying all of the traditional momentum strategy specifications applied in related literature. In addition, I test both the robustness and practical feasibility of the REIT momentum strategies by studying the effect of transaction costs and estimating REIT momentum strategies' tradable position sizes. Also the diversification benefits of REIT long-only and REIT momentum strategies can be examined. This is why I'm confident that this thesis expands not only the literature about momentum effect in REITs, but also provides deeper understanding of the underlying drivers behind the feasibility of the momentum strategies overall. The result is a deeper understanding of the momentum phenomenon in general, and the tactical investing aspects related U.S. Real Estate Investment Trusts in particular.

## 1.2 Research problem and objectives

The main objective of this thesis is to find evidence of the momentum phenomenon in the REIT market, and then study the feasibility of REIT momentum strategies from an institutional investor's point of view. This is done by thoroughly analysing the performance of 96 selected REIT momentum strategies during the time period of 1.1.1995 – 31.12.2007. At first, I construct a model which follows the overlapping portfolio methodology of Jegadeesh and Titman (1993) and calculate the excess monthly returns without transaction costs. Then, the performance of the strategies is evaluated in order find evidence which of them are the most profitable. Next I'll analyse to what extent the excess returns are caused by the traditional Fama and French risk factors, by using Fama and French (1993) three factor model methodology. I also search for evidence for the Hong et al. (1999) information diffusion theory as a possible explanation for the momentum profits. This is done by studying the magnitude of the momentum profits in two uniquely different states of the REIT market. In addition, I study the characteristics of REITs which appear in the momentum portfolios most often, the main question being if there are certain common features in these momentum REITs.

In order to test the robustness of the momentum profits and also study the practical feasibility of the momentum strategies, two different approaches are used. First, I'll study the effects of transaction costs on the momentum profits by using several transaction cost estimates calculated by Keim et al. (1997) and Jones et al. (2001) and second I estimate the potential position sizes which could be achieved by trading different REIT momentum strategies.

These two dissections not only provide evidence of the robustness of the momentum profits but what it is even more important present evidence of overall practical feasibility of the REIT momentum strategies, i.e. could a hedge fund which uses REIT momentum strategies make profit. In addition, I'll also thoroughly analyze the potential diversification benefits attainable both from REIT momentum and REIT long-only strategies during the sample period. The diversification issues are analyzed both in a recession and in general stock market downturn measured by the S&P 500 index. Also, the dynamics of the diversification benefits are analysed by utilising rolling correlation methodology throughout the sample period. The idea is to find out whether REIT momentum and REIT long-only strategies can enhance the risk return characteristics of a mixed-asset portfolio and in what kind of situations these improvements are attainable.

## 1.3 Contribution

Chui et al. (2003a and 2003b) and Glascock et al. (2003) have found that the momentum phenomenon exist in REIT market. According to their findings the average monthly excess return for six month ranking and holding periods are 0.890%, 0.984% and 0.550% respectively. All of these studies use 30% as the cut-off point when forming the winner and loser portfolios. Transaction costs are neglected in these studies. When looking at the general stock market momentum literature, many studies have documented the momentum phenomenon. For example Jegadeesh and Titman (1993 and 2001), Moskowitz and Grinblatt (1999) and Hong et al. (2000) found the monthly excess return from 6 months ranking and holding period to be 0.950%, 1.230%, 0.430% and 0.527% respectively. Jegedeesh and Titman (1993 and 2001) use 10% and Moskowitz and Grinblatt (1999) and Hong et al. (2000) use 30 % as the cut-off point when constructing the winner and loser portfolios. Also all of these returns are without transaction costs. This thesis is related to the preceding literature by using the corresponding methodology, i.e. overlapping portfolios by Jegadeesh and Titman (1993), when calculating the monthly excess momentum returns. Also this thesis uses the commonly used momentum portfolio creation styles used in the related literature, i.e. 3, 6, 9 and 12 month ranking and holding periods and 10%, 20% and 30% as the cut-off point when selecting the winner and the loser portfolios. This enables the direct comparisons of the results of this thesis to the findings in the related literature.

This thesis contributes to the current literature in numerous ways. First, it provides a comprehensive picture of REIT momentum phenomenon and momentum phenomenon

overall. Most importantly this thesis extends the work of e.g. Jegadeesh and Titman (1993 and 2001) and Chui et al. (2003a and 2003b) by studying and most importantly comparing all of the traditional momentum strategy specifications. These specifications include, the ranking period, holding period and the used cut-off point when selecting the winner and loser portfolios by using the overlapping portfolio methodology of Jegadeesh and Titman (1993). This thesis also extends the work of Fama and French (1993) by examining the extent to which the monthly REIT momentum excess returns are explained by the Fama and French (1993) three factor model. Second, this thesis adds to the understanding of the potential sources of momentum profits by testing the Hong et al. (1999) information diffusion theory in two uniquely different states of REIT market. The theory predicts that the momentum phenomenon is stronger during the time period when the information diffusion is slower. Third, this thesis also studies the common characteristics of REITs which are selected to the momentum portfolio most often, e.g. if those REITs can be considered more risky than the REITs on average. Fourth, this thesis is a first attempt to estimate the potential size of the momentum position which an institutional investor could trade when using the REIT momentum strategy. The goal is to examine the feasibility of REIT momentum strategies in practice and present evidence to the question of whether a hedge fund which uses REIT momentum strategies could make profits. In addition, robustness of momentum profits are studied by analyzing the effects of the implementation of several transaction cost estimates to the excess returns. Fifth, the diversification benefits of both REIT momentum and REIT long-only strategies are examined both in a recession and in a general stock market downturn. Finally, this thesis summarizes some of the main events and presents background information of the severe credit crisis which currently influences the world economy. The crisis which began from the U.S. real estate market is arguably the most significant economic event since the great depression in the 1920s.

## 1.4 Main results

The main finding of this thesis is that first of all, strong evidence indicates that the momentum phenomenon exist also in the REIT market. All of the 96 different individual momentum strategies studied showed positive average monthly excess returns, i.e. for six month ranking period and six month holding period strategy the monthly returns are: 0.94%, 0.60% and 0.39% for 10%, 20% and 30% cut-off point strategies respectively. In addition the strategies which use 10% as the cut-off point are the best, 20% cut-off point strategies are the 2$^{nd}$ best and finally 30% cut-off point strategies are the 3$^{rd}$ best on average in terms of returns. This

finding is in line with intuition, as the 10% cut-off point strategies use the most extreme observations, naturally they provide also the biggest returns. Also evidence indicates that the strategies which have longer ranking periods and shorter holding periods provide the best returns. Reasons behind the dominance of shorter holding periods could be that REIT momentum might experience reversals in the longer holding periods, thus decreasing the excess returns. The reason for the dominance of the longer ranking periods could be that REITs experience shorter term fluctuation and in order for the REITs which experience short term return continuation, i.e. momentum, to be selected to the momentum portfolio, one needs to use longer ranking periods. However, evidence also indicates that in practise, the REIT momentum strategies are not feasible for an institutional investor, i.e. a hedge could not make profit by trading only REIT momentum strategies. The implementation of the transaction costs critically decreases the momentum returns, thus in practise the returns would not probably exist. Also, the estimation of the REIT momentum position sizes presents evidence that the positions which a single investor could trade by using REIT momentum strategies are too small for institutional investors.

Strong evidence indicates that the momentum excess returns aren't caused by the Fama and French three risk factors, i.e. the Fama and French (1993) three factor model is unable to explain the momentum returns. Also during the subperiod in which speed of information diffusion in REITs is slower, the momentum phenomenon is stronger. This finding supports the Hong et al. (1999) information diffusion theory as a potential explanation of momentum profits. The slower information diffusion is caused by the fact that during the first subperiod REITs were not as popular as in the second subperiod. This can be seen from both lower institutional ownership and smaller market capitalizations of REITs during the first subperiod compared to the second subperiod. I also find that there are common characteristics for momentum REITs, they are i) smaller, ii) have smaller institutional ownership iii) have more leverage and more fluctuating earnings per share than REITs on average in the sample. Finally, the evidence indicates that both REIT momentum and REIT long-only strategies can provide investors with diversification benefits in a mixed-asset portfolio situation. This enhancement is attainable both in the recession and in the general stock market downturn.

## 1.5 Definition of key concepts

This section defines main concepts and helps the reader to understand the logic behind the momentum-related notation and terms used throughout this thesis. In momentum portfolio

construction, there are basically four different variables; *the cut-off point, ranking period, holding period and whether the bid-ask bounce has been taken into account or not.* Cut-off point is defined in this thesis as the point according to which the winner and loser portfolios are constructed, e.g. 10% cut-off point means that the winner portfolio consists of REITs which are in the top 10% based on performance in the ranking period, and the loser portfolio consists of REITs which are in the bottom 10% based on their performance in the ranking period. Ranking period refers to the period in which REITs performance is tracked in order to rank them. Holding period is the actual investment period. Bid-ask bounce refers to a situation in which thin trading can potentially cause bias to the momentum profits; this issue is handled by implementing a one month lag between the ranking and holding periods. In this thesis "(B)" is used to mark the strategies in which the bid-ask bounce has been taken into account and "(A)" marks the strategies in which the bid-ask bounce has not been taken into account. In total, under a single cut-off point there are always 32 strategies, i.e. two sets of 16 different holding and ranking period combinations (3, 6, 9 and 12 months), thus in one set the bid-ask bounce has been taken into account in the other it has not been taken into account. For example, the notation "10/10 R6 H6 (B)" refers to an individual momentum strategy which has 10% as the cut-off point, 6 month holding period, 6 month ranking period and the bid-ask bounce has been taken into account. As mentioned before this thesis studies 96 different individual momentum strategies.

### 1.6 Structure of the study

The paper is organised as follows. Section 2 presents the most important theoretical and empirical literature related to the topic. Section 3 presents the hypotheses for the study. Section 4 describes the data set and methodologies used in the thesis. Section 5 presents the empirical results of the thesis and finally Section 6 presents the conclusions.

## 2 Literary review

This section reviews most important literature for my thesis. Section 2.1 first briefly describes the unique characteristics of Real Estate Investment Trusts, and then presents an overview to the real estate investing and also provides summary about the credit crunch which currently affects the world economy. Section 2.2 reviews the theoretical and empirical literature from both the general and REIT-specific momentum literature. Finally, section 2.3 reviews empirical literature of the diversification benefits offered by REITs in a mixed-asset portfolio setting.

## 2.1 Real Estate Investment Trusts

The first subsection presents the key characteristics of U.S. Real Estate Investment Trusts. Second subsection presents an overview to REITs and real estate investing. Finally the third subsection reviews latest literature and presents summary of the recent U.S. real estate boom which has now led to the credit crunch that influences the global economy.

### 2.1.1 Definition and IRC's requirements for REITs

Short definition of REITs by Miles and Wurtzebach (1994) is "*An ownership entity that provides limited liability, no tax at the entity level, and liquidity*". However, the U.S. Securities and Exchange commission (2006) uses broader definition: "*Real estate investment trusts, known as REITs, are entities that invest in different kinds of real estate or real estate related assets, including shopping centres, office buildings, hotels, and mortgages secured by real estate*". There are basically three types of REITS:

- *Equity REITS*, the most common type of REIT, invest in or own real estate and make money for investors from the rents they collect;
- *Mortgage REITS* lend money to real estate owners and developers or invest in financial instruments secured by mortgages on real estate; and
- *Hybrid REITS* are a combination of equity and mortgage REITS.

The property type is a key factor in REITs as it is the underlying driver behind the profitability of the REIT. According to the Real Estate Investment Trusts Research Report (2000) some REITs specialize in one property type, such as offices, apartments, warehouses, shopping centres, hotels etc. REIT which specializes in shopping centres might face tough times when consumers are cutting their spending. Meanwhile some REITs own a mix of, for example retail and industrial properties. Naturally, these more diversified REITs are not as vulnerable as the specialized REITs are. However, if the investor wants to have exposure in a niche real estate segment then the specialized REITs can provide good options.

Price (2006) lists the Internal Revenue Code's requirements that a company must meet to qualify as a REIT:

1) Pay a minimum of 90% of its taxable income to its shareholders each year
2) Have at least 100 shareholders with no more of 5 of these holding greater than 50 % of the trust's outstanding shares

3) Be an investor of a real estate not a broker
4) Derive at least 90% of its gross income from rent and interest income, gains on the sale of property, or shares of other trusts and other real estate sources
5) Derive a minimum of 75% of its gross income from real property interests, gains on the sale of real property, and shares of other trusts and other real estate sources
6) Have at least 75% of total assets in real estate properties (equity REITs) or mortgages; cash and government securities (mortgage REITs)
7) It must be managed by one or more trustees or directors who may be individuals or corporations
8) It must issue transferrable shares
9) It may not be a financial institution or Real Estate Company

Through stock exchanges REITs are primary vehicles for individuals to own real estate while taking advantage of higher liquidity and lower transaction costs, compared to owning private real estate. Public REITs trade on the underlying value of their income producing real estate. REITs operate similar to closed end funds; they invest in real estate instead of securities. Traditional Real Estate investments demand lots of time and effort from the owner. In the case of REIT, individuals can buy as easily as regular stock from the stock exchange. (Price 2006)

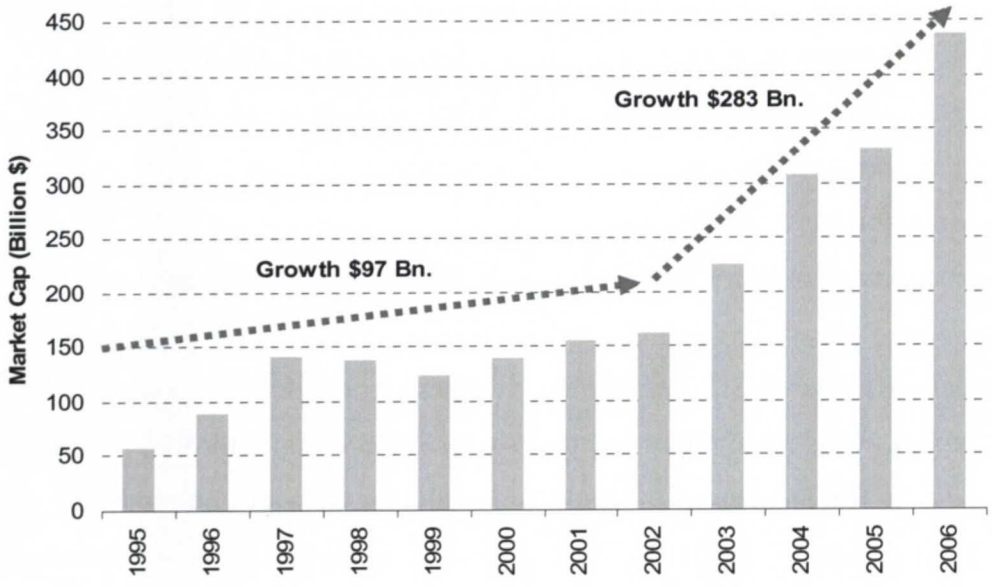
### 2.1.2 Overview of REITs and Real Estate investing in general

*History*

According to Price (2006), REITs were authorized by the U.S. Congress in 1960 and their initial idea was to provide ways for private investors to make long-term but still liquid investments to real estate. Since then, the REIT market has been eventful. In the 1970s REITs faced tough times as the building boom ended and interest rates were rising this led to maturity mismatch problems. In the 1980s, with the help of the Economic Recovery Act, REITs were able to evolve and provide good returns for investors. However, in the early 1990s, REITs again suffered, this time from underperforming properties and Mortgage REITs and Hybrid REITs were hit the hardest. Nevertheless, in the mid to late 1990s REITs were able to again provide good returns to investors due to overall low valued property markets. The overall good performance continued in the new millennium, and after 2001 along with exceptional returns the popularity of REITs exploded. This can be seen from the figure 1; the

total market capitalization of the industry grew from about $50 billion in 1995 to an astonishing $438 billion in 2006. Also the number of REITs has increased a lot in recent years and currently there are some 150 publicly traded REITs in the major U.S. stock exchanges.

**Figure 1: Historical market capitalization of publicly traded REITs 1995 - 2006**
Equity Market Capitalization Outstanding. Billions of dollars at the year end. Source: National Association of Real Estate Investment Trusts.




Main drivers behind the growth were the regulatory changes in the industry in the 1990s, combined with low interest rates and overall increased attractiveness of real estate. One of the major changes in the industry was the creation of the so called umbrella partnership structure REIT ("UPREIT") in 1992. According to Price (2006), the UPREIT consists of two entities: a REIT and an operating partnership ("OP"). The REIT issues shares of stock to the investment public and the proceeds from the issue are used to purchase properties and controlling interest in the OP. With the UPREIT structure, the REIT owns properties indirectly trough the OP. The structure allows for securitization of real estate by allowing the operating partners delayed tax assessment until a time when the benefits of the conversion are the greatest. This motivates owners of private real estate to move their holdings to an UPREIT. The change caused by the UPREIT structure issue has been so significant that Ling et al. (1997) argue that it has made REITs more difficult to value, e.g. increasing the underpricing in the REIT IPOs.

Another important additions to the legislation were the REIT Simplification Act of 1997 ("REITSA") and the REIT Modernisation Act of 1999 ("RMA"). They gave REITs more

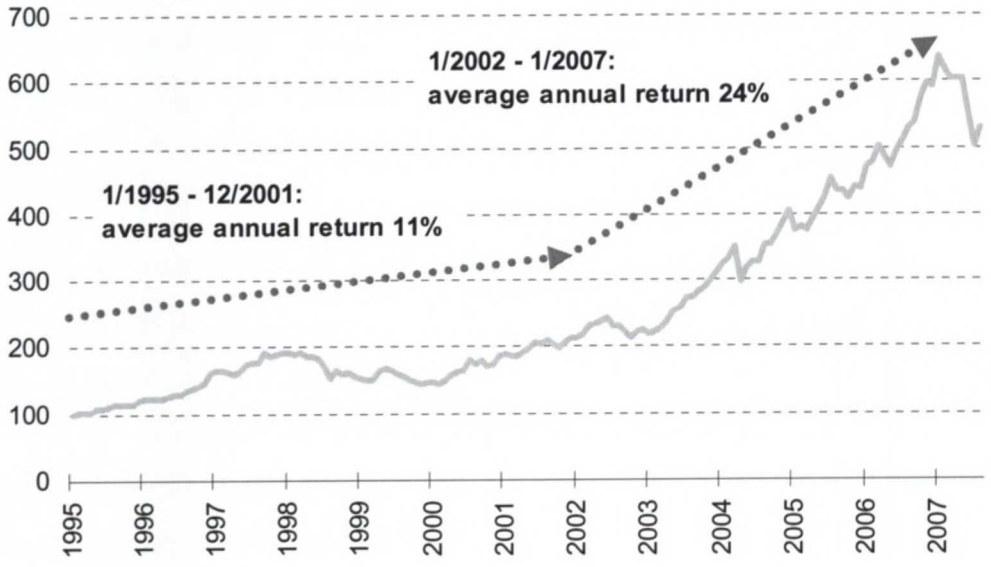
operating flexibility. REITSA eliminated the tax on shareholders who received retained capital gains distributed at a later date and repealed the provision requiring that a REIT cannot earn more than 30% of its gross income from the sale of assets not held as long term investments. RMA reduced the required distribution of taxable earnings from 95 % to 90 %, thus this presented an opportunity for more aggressive acquisitions because of the increased retained earnings. (Price 2006)

Figure 1 presents comprehensive evidence of how the REIT market capitalization has grown a lot more in the period after the IT bubble compared to the period before it. During this latter period the market capitalization growth was $186 Bn. bigger than in the former period. There are few reasons for this development. First of all, after the recession in 2001 following IT bubble, interest rates were low as the government tried to stimulate the economy back on the growth track. Second, due to the low interest rates, banks were able to provide financing for real estate transactions with attractive terms which fuelled the growth in the real estate market.

Financing is a key element in real estate transactions as they typically use big amount of debt, for example according to McDonald (2004) opportunistic real estate transactions have typically LTV[4] ratios of over 70%. Due to these reasons also the returns which the REITs delivered to investors exploded; according to the figure 2 REITs provided 11% average annual return between 1/1995 – 12/2001 and a staggering 24% average annual return in between 1/2002 – 1/2007. These two clearly different phases in the REIT market during the sample period are very interesting observations. They enable the testing of Hong et al. (1999) information diffusion theory as the potential explanation of momentum profits, i.e. during the former subperiod the momentum phenomena should be stronger as the information diffusion was slower than in the latter subperiod as then REITs were more popular among investors.

[4] The loan-to-value (LTV) ratio is a mathematical calculation which expresses the amount of a first mortgage lien as a percentage of the total appraised value of real property.

**Figure 2: Monthly cumulative total return of REITs 1/1995 – 8/2007, 1/1995 = 100**
The index includes dividends and price appreciation. Source: National Association of Real Estate Investment trusts.




*Basics of Real Estate investing*

Investing in real estate asset class is based on the cash flow which the real estate asset generates, thus it has fixed income product characteristics. For the investor the most important components of the cash flow are rental yield and the price which the investor receives when he or she sells it to a third party, i.e. exit price. Rental yield can be calculated basically by subtracting the costs which the owner has to pay from the rental income which the tenant pays to the owner. In the real estate terminology, the cash flow which the investor gets after property costs is referred as net operating income, i.e. NOI. When determining the value of the real estate asset the NOI is capitalized by the required rate of return, this is referred as the capitalization valuation method. Also cash flow to equity, i.e. equity IRR valuation method is nowadays popular among the real estate investors. In the equity IRR method, free cash flow to equity is calculated for certain time period with several assumptions, e.g. about exit price and leverage, and then the value of the property is estimated by the appropriate equity IRR.

**Table 1: Summary of real estate investment styles**

Table presents different real estate investment styles and their characteristics. *Core* represents a low risk/low return strategy that is typically long-term in nature. Investors invest in *Core* real estate due to its high income yield and stable bond-like characteristics. *Core Plus* differs from *Core* in that properties at the time of the purchase require some type of enhancement to turn them into *core* properties. *Value-Added* in it's basic form involves buying a property, improving it in some way and then selling it for profit. *Opportunistic* investing represents the highest-risk and highest-return strategy. Investors invest in *Opportunistic* real estate due to its potential to generate high returns rather than for diversification benefits. NCREIF is U.S. real estate return index calculated by National Council of Real Estate Investment Fiduciaries and typically is in between -6% to +6% on quarterly level. Source: McDonald (2004)

| | Style | | | |
|---|---|---|---|---|
| **Attribute** | **Core** | **Core Plus** | **Value-Added** | **Opportunistic** |
| **Expected Return** | NCREIF + 100 Basis Points | NCREIF + 200 - 300 Basis Points | Low double digits to mid-teens | High teens and upwards |
| **Income/ Appreciation** | Greater than 75 % of return is income | High income yields given that funds typically contain a high percentage of core properties | Income and appreciation | Mostly appreciation |
| **Leverage** | 0-30 % | 30-55 % | 50 - 70 % | 70 % + |
| **Diversification** | Fully diversified | Moderate diversification | Limited diversification | Diversification not a consideration |
| **Life cycle** | Existing, fully leased | Existing fully leased plus properties requiring moderate repositioning | Existing - but require redevelopment/ releasing/ repositioning | Development and/or existing properties that require extensive redevelopment/releasing |
| **Holding period** | Buy and hold | Buy, implement strategy and hold | 3 to 7 years | Implement strategy and sell |
| **Property Types** | 4 property types (apartment, offices,industrial and retail) | 4 property types (apartment, offices, industrial and retail) | 4 main property types and lodging | All property types including niche sector |
| **Markets** | Primary markets | Primary/secondary markets | Primary/secondary markets | Domestic and international |
| **Property Class** | Class A | Class A and lower quality properties | Typically lower quality buildings but can be converted to Class A | Typically lower quality buildings but can be converted to Class A |
| **Fund Structure** | Open-end | Open-end and closed-end | Typically closed-end but some are open-end vehicles | Closed-end |
| **Fee Structure** | Based on assets under management | Varies - can either be asset based or incentive based | Based on committed capital plus incentive fees | Based on commited capital plus incetive fees |
| **Liquidity** | High | Moderate - depending on fund structure | Moderate - depending on fund structure | Low |

Real Estate investing can be roughly categorized into 4 different styles, i.e. *Core, Core Plus, Value-Added* and *Opportunistic*. Table 1 summarizes the key aspects of the four styles. These styles differ in many ways. Core is the least risky and opportunistic is the most risky strategy. Typical core investment would be a high class property which is almost fully let, with good tenants and long lease contract. In this kind of investment there aren't many value creation opportunities but the risks are also pretty low, i.e. the investor can just enjoy the steady cash flow which the tenant pays. In Core Plus and Value-Added strategies the property possesses

some kind of clear value creation opportunities; e.g. vacancy, low rents compared to the market rental levels, cost structure optimization etc. In this case the investor needs to work on the property a lot more than in the core strategy, but with active management he can create more value for the investment.

The most important driver in real estate investing is the location of the property. Its importance cannot be overstated. The importance of location can be easily explained by the fact that it's the only constant in real estate investing, i.e. it cannot be altered. Buildings can be torn down and tenants can be changed but the location of the asset on earth is fixed. That's why it's important to think also about the future, how good will the location be in the next ten years? When evaluating the location, the investor has to also take into consideration the interaction of the property with its surroundings, e.g. if a residential building is in a good neighbourhood but next to it is a really busy street, the property is not as valuable as a residential building in the same area but next to a quiet side street. Also authorities can affect the property's attractiveness trough zoning, e.g. by drawing a plan to build new road next to the investor's property, thus causing serious threat of depreciation to the value of the property. The investor has to stay aware of politicians' and city authorities' plans for the future of the surroundings of the property as they can possibly cause harm to the investment.

### *2.1.3 U.S. Credit Crunch 2007*

Gradually during the spring and summer of 2007 the U.S. real estate and credit market started showing some bad sings. The boom which had continued for many years started turning into a big bust. One of the main drivers behind the crash was the subprime mortgages[5] and the bursting of the housing bubble in the U.S. This lead to home mortgage defaults and increased real estate foreclosure activity. Subsequently the phenomenon spread to the entire economy and became a credit crunch. The situation has remained challenging also during 2008 as the liquidity of the credit market has dried up, thus the banks do not trust each other anymore. This has forced U.S. Federal Reserve to provide emergency financing to the market, e.g. in 22.1.2008 the FED unexpectedly lowered the Federal Funds rate by 75 basis points, responding to a global downturn of the stock market (MSNBC 2008a). At the moment the final outcome from this crisis in the financial market remains to be seen.

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[5] Subprime lending is lending at a higher rate than the prime rate. The term "subprime" refers to the credit status of the borrower (being less than ideal), not the interest rate on the loan itself. Subprime loans are granted to borrowers which do not qualify for normal loans, i.e. they have bad credit history or low income.

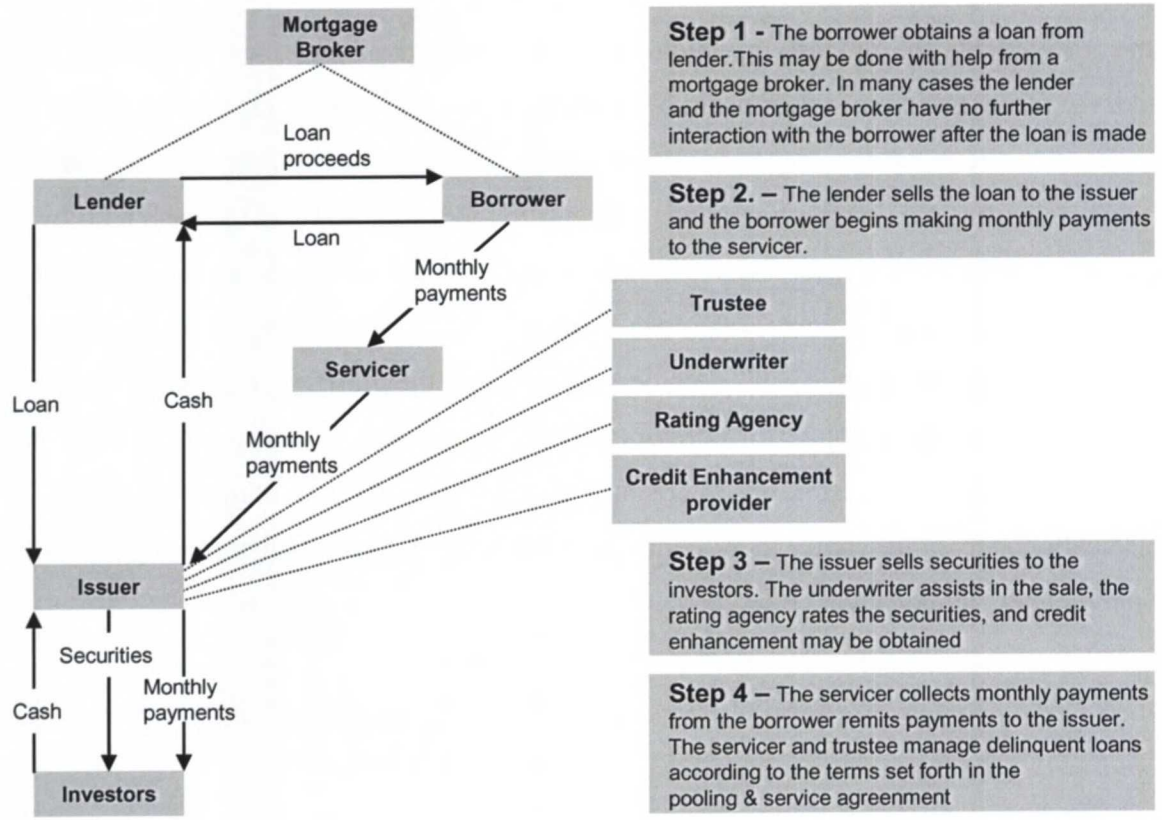
*Background*

One of the main reasons behind the crisis has been the housing bubble in the U.S. and also the securitization of subprime loans and also other types of loan instruments. The securitization or pooling of debt is a complex procedure in which several parties are involved. The idea in securitization is to first form pools of debt and then sell individual tranches to investors. These tranches entitle to a part of the cash paid to the pool by the borrowers, i.e. amortization of debt and interest payments. By securitizing debt banks can lend more as they can sell their debt exposure to the investors.

Figure 3 highlights the process in which the loan is securitized and then sold to investors. Unlike the more traditional relationship between borrower and lender, securitization involves the sale of the loan by the lender to a new owner, i.e. issuer who then sells securities to investors. The investors are buying bonds that entitle them to a share of the cash paid by the borrowers on their mortgages. Once the lender has sold the mortgage to the issuer, it no longer has the power to restructure the loan or make other accommodations for its borrower. That becomes the responsibility of a servicer, who collects the mortgage payments, distributes them to the issuer for payment to investors and if the borrower cannot pay, takes action to recover cash for the investor. As there are so many parties and components involved, securitizations are significantly more complicated than the traditional lending process which has only lender and borrower (Bair 2007).

**Figure 3: Borrowing under securitization structure**

Figure highlights the process of securitization of debt, e.g. mortgages. Issuer is a bankruptcy-remote special purpose Entity ("SPE") formed to facilitate a securitisation and to issue securities to investors. "Bankruptcy remote" means that and SPE's obligations are secure even if the lender defaults, i.e. due to its legal status and balance sheet structure the SPE and its debt issuances aren't affected by the bankruptcy of the lender. Lender is an entity that underwrites and funds the loans that are eventually sold to SPE for inclusion in the securitization. Mortgage broker acts as a facilitator between borrower and the lender. Servicer is an entity responsible for collecting the loan payments from borrowers and for remitting these payments to the issuer for distribution to the investors. Investors are the purchasers of various securities issued by a securitization. Rating agency assigns initial ratings to the securities issued by the issuer and updates these ratings. Trustee is a third party appointed to represent the investors' interests in a securitization. Underwriter administers the issuance of securities to investors. Securitization transactions may also include credit enhancement provided by an independent third party, i.e. credit enhancement provider in the form of letters of credit or guarantees. (Source: Bair Sheila C., Chairman, Federal Deposit Insurance Corporation (2007))




Many parties have influenced on the birth of the current credit crisis. The borrowers have taken too big loans which they couldn't afford in the beginning. Financial institutions have been too eager to grant loans for borrowers with low income and bad credit history, i.e. subprime. According to Demyanyk et al. (2008) the spread between subprime and prime mortgages declined from 280 basis points in 2001 to 100 basis points in 2006. In other words the risk premium required by lenders declined even though at the same time overall subprime borrower and lender characteristics worsened. Demyanyk et al. (2008) point out that this behaviour is typical in classic boom and bust credit cycles. Mortgage brokers, which do not lend money but act as middlemen, pushed aggressively for more loan products to the market,

in order to get compensation. The regulators are also to blame. Kuttner (2007) argues that the Glass-Steagall act, which regulates the commercial banks and gives them access to federal deposit insurance but lets investment banks speculate freely, also contributed to the credit crisis. Kuttner also agues that the Federal Reserve's eagerness to bail out financial institutions in trouble created hubris to the market, as speculators could trust that FED would rescue them if things started to look bad. The markets started referring this as the "Greenspan put". Good example of this kind of behaviour is the famous Long Term Capital Management crisis, in which FED led the rescue operation of one of the biggest hedge funds of all time. Also Credit rating agencies are currently being investigated whether they gave too good ratings for subprime loans, thus providing misleading information to the investors about the risks related to these instruments. The former chairman of U.S. Federal Reserve Alan Greenspan has also been criticized lately by economists who believe that his actions fuelled the crisis. Mr. Greenspan has defended himself by arguing that he or the Federal Reserve is not to blame for the credit crunch and that even with tighter regulation a crisis would still have emerged[6].

*Effects*

One of the first major sings of the crises were seen in August 9th 2007 as BNP Paribas SA, the biggest bank in France, closed 3 of its investment funds, because it couldn't fairly value their holdings anymore. In response to this, London Interbank Offer Rate (LIBOR) rose more than 50 basis points in that day. Meanwhile, the European Central Bank injected more than $130 billion to the market in the biggest emergency operation since the September 2001 terrorist attacks. The Federal Reserve followed with unusually aggressive open market operations of its own, only a few hours later. Interestingly, only a few days earlier the Fed had decided to leave monetary policy unchanged and had issued a statement that the biggest concern for the economy was inflation. However, on August 17th as the credit market had worsened the Federal Reserve slashed the discount rate by 50 basis points (Greenlaw et al. 2008).

The market sentiment deteriorated further in October when a wave of downgrades of mortgage bond ratings emerged. Between October 11th and 19th, Moody's and Standard & Poor's each downgraded more than 2500 subprime mortgage bonds, totalling about $80 billion in original face value. From mid October, negative sentiment started to once again spill over from mortgages into broader credit market, as investors refocused on problems with

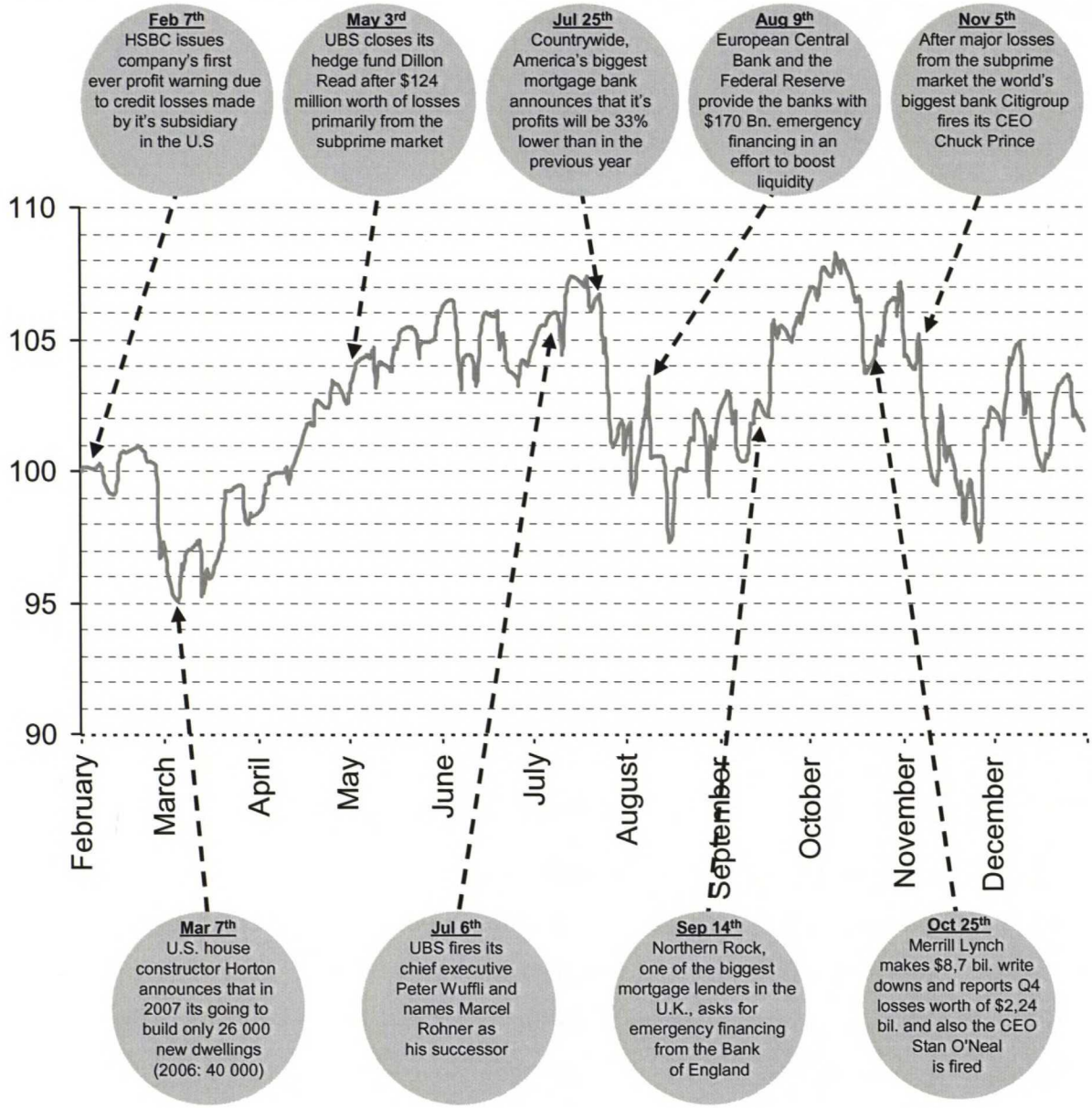
[6] http://blogs.ft.com/wolfforum/2008/04/alan-greenspan-a-response-to-my-critics/

exposure to risky assets. One sign of continuing uncertainty about the size and distribution of losses was the pricing of credit protection against the default risk of banks and other financial institutions, which pointed to growing concerns about financial sector strains. Further downgrades took place on October 23rd as Standard and Poor's lowered the ratings on 145 tranches from CDOs worth of $3,7 billion in total issuance amount. Quickly after that Moody's downgraded 117 CDO tranches and Fitch placed some $37 billion in CDOs on review for possible downgrade. (Bank for International Settlement Quarterly Review December 2007)

Figure 4 presents the S&P 500 stock index along with some of the major events of the credit crunch. From the figure one can clearly see that there was big volatility in the general stock market during the period. However, after all that fluctuation the S&P 500 index was almost at the same level in December than in February, signalling that the markets trusted the central banks' ability to handle the crisis and that the good market fundamentals had not yet changed.

The single biggest crash occurred in August, as at that time central banks initiated emergency financing to provide more liquidity to the market. The credit crunch turned into global financial crisis when Northern Rock, the oldest mortgage bank in the U.K. fell into the hands of Bank of England after a serious bank run in September 14th. This event caused lots of noise in the U.K. and people started questioning the durability of the modern financial system. After all, the previous bank run in the U.K. occurred in more than a century ago (BBC News 2008).

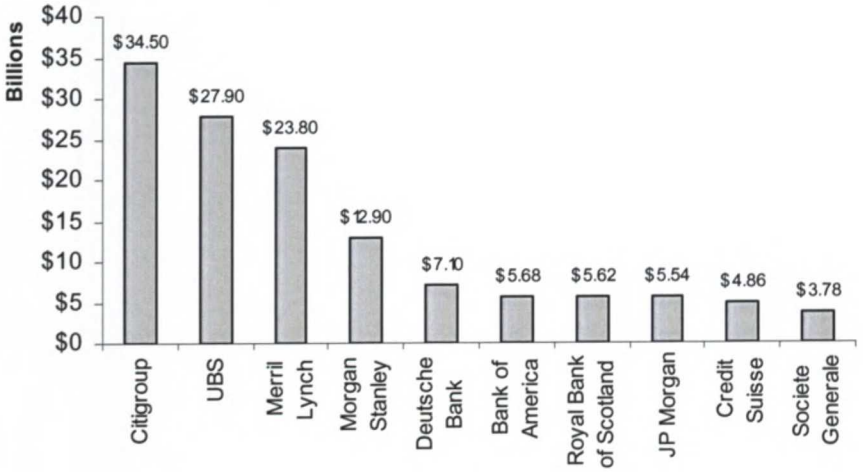
**Figure 4: S&P 500 stock index and some major events of the credit crunch**
Figure presents the S&P 500 stock index performance during February – December 2007, 1.2.2007 = 100. Event information sources: MSNBC, New York Times, Bloomberg, Deal Breaker, BBC and CNN.




These events triggered an intense examination of investor exposure to the U.S. mortgage market. It was obvious that investors and financial institutions had taken positions in high risk instruments and that BNP Paribas' followers would emerge. As was expected, many financial institutions announced big write downs of different credit securities throughout the fall of 2007 and the beginning of 2008. The instruments had become almost worthless, thus the institutions removed them from their balance sheets. Figure 5 presents the biggest cumulative writedowns made by some of the major financial institutions in the world. The data is gathered from E-Financial news and is through 18.4.2008. Currently the undisputed leader of

this "league table" is Citigroup, which has already changed its CEO in the aftermath of the credit crunch. It is very likely that there will be more write downs in the near future so the final resolution of the crises remains to be seen.

**Figure 5: Financial institutions responsible for the biggest writedowns**
Figure presents 10 biggest cumulative writedowns of mortgage backed securities (MBS) and Collateralized debt obligations (CDO) made by financial institutions due to the credit crunch. Data is through 18.4.2008. Source: E-financial news.




## 2.2 *Momentum phenomenon in stock market returns*

The first subsection describes the factors behind the momentum phenomenon in detail. Also the momentum study methods are discussed. The second subsection presents the theoretical momentum literature. Third subsection reviews the empirical evidence both from the general stock market momentum and momentum in REIT market. Finally, fourth subsection reviews the literature related to transaction costs in momentum strategies.

### *2.2.1 Overview of momentum phenomenon*

*Definition*

The momentum phenomenon is based on the idea that stocks with high returns in the recent past have higher future returns than stocks with low past returns. The momentum phenomenon is typically defined as a positive relation between the return of a stock in a certain period with its lagged return. (Swinkels 2004)

Swinkels (2004) defines momentum phenomenon by the following equation:

$$E\left\{\frac{1}{N}\sum_{i=1}^{N}(R_{i,t-1}-\overline{R}_{t-1})(R_{i,t}-\overline{R}_{t})\right\}>0 \qquad (1)$$

Where, $R_{i,t}$ is the return of stock i in period t, $\overline{R}_t$ is the average return of the sample and $N$ is number of stocks

The index i is used above to denote individual stocks, but it can also be used to denote, e.g. country or industry indices when momentum at the aggregate level is being investigated. The equation states that if stock i had good performance in period t-1 then it will also have good performance in period t, when compared to the whole sample. Same also applies to the stocks with bad performance, i.e. stocks with bad performance in period t-1 will also have bad performance in period t, when again compared to the whole sample.

Jegadeesh and Titman (1993) present a single factor model which decomposes the excess returns, i.e. momentum profits into 3 different parts, thus identifying important sources of those profits. Two of these components are related to systematic risk, i.e. they would exit also in an efficient market. Third component is related to firm-specific returns, which would contribute to the momentum returns only if the market were inefficient. The model can be stated as:

$$r_{it} = \mu_i + b_i f_t + e_{it} \qquad (2)$$
$$E(f_t) = 0$$
$$E(e_{it}) = 0$$
$$Cov(e_{it}, f_t) = 0, \quad \forall i$$
$$Cov(e_{it}, e_{jt-1}) = 0, \quad \forall i \neq j$$

Where, $r_{it}$ is the return of security i time t, $\mu_i$ is the unconditional expected return on security i, $f_t$ is the unconditional unexpected return on a risk factor, e.g. market portfolio at time t, $e_{it}$ is the firm specific component of return at time t and $b_i$ is the factor sensitivity of security i.

As was previously demonstrated, if momentum strategies generate positive returns then stocks which had good performance in the first period will keep performing well in the second period. This can be stated as a positive covariance equation:

$$E[(r_{it} - \bar{r}_t)(r_{it-1} - \bar{r}_{t-1})] > 0 \quad (3)$$

The covariance equation (3) can be then further decomposed into three components:

$$E[(r_{it} - \bar{r}_t)(r_{it-1} - \bar{r}_{t-1})] = \sigma_\mu^2 + \sigma_b^2 Cov(f_t, f_{t-1}) + \overline{Cov}(e_{it}, e_{it-1}) \quad (4)$$

Where, $\sigma^2_\mu$ denotes cross-sectional variance of expected returns and $\sigma^2_b$ is the cross sectional variance of factor sensitivities. The first term on the right hand size of the equation is the cross sectional dispersion in expected returns. Securities with relatively high return in one period can be expected to have higher than average returns in next period, thus the realized returns contain a component related to expected returns. The second term is related to the potential to time the factor. If the factor portfolio returns exhibit positive serial correlation, the momentum strategy will tend to pick stocks with high b's when the conditional expectation of the factor portfolio return is high. The last term in the equation is the average serial co-variance of the idiosyncratic components of security returns.

Based on their model Jegadeesh and Titman (1993) argue that if the momentum profits are due to either the first or the second term of the equation (4) they may be attributed to compensation for bearing systematic risk, thus aren't an indication of market inefficiency. However, if the momentum profits are due to the third term, then there might be market inefficiency involved.

*Time period*

Momentum research usually focuses on short-term, medium-term or long-term momentum. Short-term typically means weeks, medium-term is approximately 1-12 months and long-term is usually over a year. The selected time period is very important as, e.g. if a study finds that short term momentum strategy generates abnormal profits, then to capture them investor would have trade often and this might perhaps make the strategy unprofitable.

*Bid-ask bounce*

Bid-ask bounce refers to a situation in which small and illiquid stock faces high relative price change, even though the change is small in absolute terms. Thus, it may seem that the stock value has changed significantly, i.e. the market has changed its view about the stock albeit it's just because of the high bid-ask spread which causes the significant relative change in the stock price.

Peltola (2002) points out that illiquidity and non-synchronised trading could potentially create spurious estimations of first-order serial autocorrelation and bias the momentum profits downwards. However, the resulting bias is likely to be minimal when monthly returns are used, but it might have an impact at least for the shorter horizon trading strategies. In the related literature the issue is fixed by delaying the formation of the zero cost momentum portfolio between the ranking period and holding period by a predetermined time period, e.g. one month in order to avoid the potential bias caused by the bid-ask bounce

### 2.2.2 Theories behind the momentum phenomenon

Current theories of momentum phenomenon can be categorized into two groups: *risk-based theories and behavioural theories*. Supporters of risk-based explanations believe that momentum returns are compensation for risk that is not captured by current asset-pricing models. As a result, momentum profits are not "abnormal" and they do not contradict the efficient market hypothesis. On the other hand behavioural models argue that investors' irrational overreaction or under-reaction to stock news cause momentum phenomenon and contribute to momentum returns. (Glascock et al. 2003)

*Risk-based theories*

These theories hypothesise that the possible momentum profits are reward for bearing some kind of risk. Over the years researchers have tried to explain the momentum phenomenon with many different types of risk models. Jegadeesh and Titman (1993) study if the excess returns generated by the momentum investing are due to a positive CAPM beta, by testing both average and risk adjusted returns. Their findings suggest that differences in market risk do not cause momentum profits.

Fama and French (1996) try to explain the short-term momentum profits by the Fama and French (1993) three factor model. Their results indicate that the three factor model misses the

continuation of returns for portfolios formed on short-term past returns. In the three-factor regressions for these portfolios, the intercepts are strongly negative for short-term losers (low past returns) and strongly positive for short term winners. The problem is that losers load more on SMB and HML than winners, so the model misses the observed continuation. Thus, they conclude that their unconditional three factor model is unable to capture the continuation of short-term returns documented by Jegadeesh and Titman (1993).

Wu (2002) argues that one potential reason for the Fama and French three factor model's failure to capture the short term momentum may be that the assets' exposures to SMB and HML factors are indeed time-varying, and that time-variation characteristics of different assets, which are missed by the unconditional FF tests, may play and important role in asset pricing. Wu (2002) uses a conditional version of the Fama French (1993) three factor model in explaining the short term momentum returns. Wu's model is defined as follows:

$$E\left(r_{i,t+1}\middle|\Omega_t\right)=\beta_{mt}E\left(EMR_{t+1}\middle|\Omega_t\right)+\beta_{st}E\left(SMB_{t+1}\middle|\Omega_t\right)+\beta_{ht}E\left(HML_{t+1}\middle|\Omega_t\right) \qquad (5)$$

Where, $r_{i,t+1}$ is the return of asset i from time t to t+1 in excess of the risk free rate; $EMR_{t+1}$ is the return on the market portfolio in excess of a risk free rate; $SMB_{t+1}$ is the mimicking portfolio return used to capture the size effect; $HML_{t+1}$ is the mimicking portfolio return to explain relative distress; $\Omega_t$ is the information set that investors rely upon to balance their portfolios through time; $E\left(.\middle|\Omega_t\right)$ is the expectation conditioned on information at time t; $\beta_{mt}$ is the market risk; $\beta_{st}$ is the state risk arising from investors' special hedging concerns associated with size; and $\beta_{ht}$ is the risk arising from special hedging concerns related to relative distress. In a conditional setting risk measures as well as risk premiums are supposed to vary through time. Wu finds evidence that risk exposures, particularly to SMB and HML, for the best winners and worst losers tend to be time varying. Moreover, in contrast to their similar unconditional risk patterns between return momentum and reversal, these two opposite kind of portfolios do have different conditional risk characteristics. His results show that, like SMB risks, the HML risks for the short-term winners and losers are significantly negatively cross-correlated while the HML risks for long-term winners and losers are significantly positively cross-correlated. However, his approach cannot explain the momentum profits completely, since the null hypothesis that $\alpha$ equals zero is still rejected using his model.

Griffin et al. (2003) analyze if the momentum profits can be explained by macroeconomic risk internationally. They use the widely cited unconditional approach of Chen, Roll and Ross (1986).

$$WML_{j,t} = \alpha_j + \beta_{UI,j} UI_{j,t} + \beta_{DEI,j} DEI_{j,t} + \beta_{UTS,j} UTS_{j,t} + \beta_{MP,j} MP_{j,t} + \varepsilon_{j,t} \qquad (6)$$

Where, $WML_{j,t}$ is the observed momentum to be regressed; $UI_{j,t}$ is unexpected inflation; $DEI_{j,t}$ is changes in expected inflation; $UTS_{j,t}$ is term spread; $MP_{j,t}$ is changes for industrial production. Their results indicate first of all that momentum portfolio profits are large and positive abroad and they only weakly comove among 40 countries, whether within regions or across continents. These findings support the notion that if macroeconomic risk is driving momentum, then it should be largely country specific. However, in the 17 markets where they had valid data, momentum profits bear basically no statistically or economically significant relation to the Chen et al. (1986) macroeconomic factors. Thus, they conclude that the model doesn't provide evidence that macroeconomic risk variables can explain the momentum.

The empirical results for a risk-based explanation for the existence of momentum strategies are mixed. While traditional unconditional pricing models are unable to explain the excess returns on momentum strategies, there is some evidence that models with time-varying risk premia can provide a risk-based explanation for the existence of the momentum phenomenon. However, these conditional models require an increased number of parameters and, hence explanations might be spurious. In summary, there is no widespread agreement that excess momentum returns are a trivial and well-understood compensation for bearing exposure to higher risk. (Swinkels 2004)

*Behavioural theories*

The lack of straightforward risk-based explanations of the momentum phenomenon has led to research papers in which the trading behaviour of investors is analysed in further detail. Several anecdotal examples challenging the often-assumed fully rational behaviour of investors have been put forward to motivate research in this field. Apparent irrational behaviour might be due to psychological factors underlying the human decision making process because different investor types have different information sets on which they condition their trading decision. (Swinkels 2004)

Behavioural model that describes a single artefact in the data by irrational trading behaviour does not in itself provide much new insight, as the assumed behaviour might be modelled such that the outcome fits with the observed trading data. Therefore, at least three aspects of behavioural models should be evaluated separately. First, the assumed investor behaviour should be plausible and derived from known behavioural patterns in psychology or related fields. Systematic biases such as overconfidence or conservatism are well known in certain psychological settings, and could therefore potentially affect stock prices as a whole. Secondly, other stylised facts from market price dynamics should also fit with the predictions from the behavioural models. For example, a behavioural model that also explains the value effect is stronger than a model that is only able to capture momentum returns. Finally, the model should make predictions about observable features in the stock market that have not yet been established. These predictions should be tested empirically in order to evaluate the assumptions of the model. (Swinkels 2004)

Daniel et al. (1998) argue that investor overconfidence is a potential source for momentum. Their logic is that if an informed investor who initially isn't overconfident and who buys or sells a security based on his private information and after that the market confirms his view by sending a positive signal, then the investor becomes more and more confident and is eager to overreact to the information. The continuing overreaction then leads to positive autocorrelation, which generates momentum. Naturally key assumption which the researchers make is that if the market sends an opposite signal after the investor has made a transaction, then negative effect on the overconfidence is smaller compared to the positive effect. The theory proposed by Daniel et al. (1998) is an interesting one as it basically states that investors systematically overestimate their own abilities. There have been studies that people tend on average overestimate e.g. their driving skills so they also might overestimate their investor skills. The key point in their theory is that investors' overconfidence increases after a favourable market movement but if an unfavourable movement happens investors think it is due some external factors.

Barberis et al. (1998) present a model which is motivated by two important phenomena documented by psychologists: conservatism and representativeness heuristic. Conservatism states that individuals are slow to change their beliefs in the face of new evidence. Individuals subject to conservatism might disregard the full information content of an earnings announcement, perhaps because they believe that this number contains a large temporary

component, and still cling at least partially to their prior estimates of earnings. As a consequence, they might adjust their valuation of shares only partially in response to the announcement. A second important phenomenon is the representativeness heuristic, which e.g. means that if a company has consistent history of earnings growth over several years, accompanied as it may be by salient and enthusiastic descriptions of its products and management investors might conclude that the past history is representative of an underlying earnings growth potential. While a consistent pattern of high growth may be nothing more than a random draw for a few lucky firms, investors see "order among chaos" and infer from the in-sample growth path that the firm belongs to small and distinct population of firms whose earnings just keep growing. As a consequence, investors using the representativeness heuristic might disregard the reality that a history of high earnings growth is unlikely to repeat itself; they will overvalue the company, and be disappointed in the future when the forecasted earnings growth fails to materialise.

Hong et al. (1999) present a model in which they divide investors to two types: "news watchers" and "momentum traders". Each investor type has different information set but both of them act rationally and follow their respective information sets. The newswatchers make estimations based on information that they privately observe about future fundamentals and their limitation is that they do not condition on current or past prices. Momentum traders on the other hand, do condition on past price changes, but their limitation is that their forecasts must be "simple" functions of the history of past prices. The critical assumption in their model is that fundamental information about the firm spreads slowly among the investors, leading initially to under-reaction. After the initial price reaction momentum traders, acting as arbitrageurs, remove any under reaction left behind by newswatchers. The return in the next period might go up because of more good news circulating among the newswatchers, but also because of the momentum traders' demand. Their model predicts that momentum should be more evident for firms with low information dissemination, i.e. small stocks and stocks with low analyst coverage.

Barberis et al. (2003) present a model in which some investors categorize risky assets into different styles and move funds among these styles depending on their relative performance. They also assume that economy consists of two types of traders "switchers" and "fundamental traders". The investment policy of switchers has two distinctive characteristics; first, they allocate funds at the level of style. Second, how much they allocate to each style depends on

that style's past performance relative to other styles, i.e. in each period switchers allocate more funds to styles with better than average performance and finance these additional investments by taking funds away from styles with below average performance. Fundamental traders are assumed to act as arbitrageurs and they try to prevent the price of each asset from deviating too far from its expected final dividend. Their model predicts positive own-autocorrelations and negative cross-correlations in the short run, and the opposite sign in the long run. In addition, asset-level momentum and value strategies are profitable in their model, and they also predict that style-level momentum and value strategies can be as profitable or even more profitable than their asset-level counterparts. Their predictions about time series auto correlations reflect the fact that in our economy, investment styles follow a specific life cycle. The birth of a style is often triggered by good fundamental news about the securities in the style, e.g. the dotcom bubble. The style then matures as its good performance recruits new funds, further raising the prices of securities belonging to that style. Finally the style collapses either because of arbitrage or because of bad fundamental news.

These behavioural theories give interesting ways of thinking about the momentum phenomenon. As Swinkels (2004) points out several behavioural aspects have been modelled and the parameters can be calibrated such that stylised facts from observed stock returns are obtained. However, the problem is that if these behavioural models cannot make predictions of unknown return patterns that can subsequently be tested, scepticism will most likely remain.

### 2.2.3 Empirical evidence about the momentum phenomenon

*General stock market momentum*

Jegadeesh and Titman (1993) were the first ones who reported a continuation in stock market returns, i.e. the momentum phenomenon. In their seminal paper they study the performance of winner, loser and winner minus loser portfolios for 3, 6, 9 and 12 month holding and ranking periods. They rank stocks in deciles after their performance in the ranking period and after that they form equally weighted winner portfolio from the top decile and equally weighted loser portfolio from the bottom decile. They also measure the performance of the portfolios with the skipping period, i.e. after the ranking period they skip one week before forming the winner and loser portfolios. This procedure decreases the effect of possible bid-ask bounce and infrequent trading. Their results indicate that trading strategies that buy past winners and sell past losers realize significant abnormal returns over the 1965 to 1989 period, e.g. strategy

which selects stocks based on their past 6-month returns and holds them for 6 months realizes annual compounded excess return of 12.01 % on average. They also find that profitability of the relative strength profits cannot be attributed to lead-lag effect that results from delayed stock price reactions to common factors.

Conrad and Kaul (1998) study momentum phenomenon for a time period of 1962 – 1989 with 1-week, 3-month, 9-month, 12-month, 18-month, 24-month and 36-month horizons. They implement strategies in which the length of the past performance evaluation period and the future holding periods are identical. For robustness of their empirical decomposition of profits from trading strategies they conduct bootstrap and Monte Carlo simulations of the medium term (3-to 12-month) strategies, in which they attempt to eliminate the time series properties of security returns while maintaining their unconditional cross-sectional characteristics. The results from the simulations are consistent with the hypothesis that the profits of momentum strategies are largely due to cross-sectional variation in mean returns. Their results indicate that momentum strategy usually delivers positive and statistically significant profits at the medium horizons (3 to 12 months), except for the 1926 – 1947 subperiod.

Moskowitz and Grinblatt (1999) study whether industry component of stock returns contribute for the individual stock momentum anomaly. They focus on intermediate investment horizons of 6 to 12 months and by using CRSP and COMPUSTAT data files they form 20 value-weighted industry portfolios every month from July 1963 to July 1995. The average number of stocks per industry is 230 and the smallest number of stocks at any industry except railroads is more than 25, thus almost all portfolios are well diversified so that they have insignificant firm-specific risk. Their results indicate that industry portfolios exhibit significant momentum even after controlling for size, book-to-market equity, individual stock momentum, the cross-sectional dispersion in mean returns and potential microstructure influences. They also find evidence that once returns are adjusted for industry effects, momentum profits from individual equities are significantly weaker and statistically significant and that industry momentum strategies are robust to a variety of methodologies and they appear to be profitable even among the largest, most liquid stocks. However, even though Moskowitz and Grinblatt (1999) present strong and robust evidence about industry momentum phenomenon, they do not state why such an effect might or should exist and conclude that the subject requires more research.

Hong et al. (2000) test the gradual information model of Hong and Stein (1999), which proposes that momentum is a consequence of investor under-reaction caused by the slow information diffusion across the investing public. They study the subject by sorting firms to different classes, for which information is a priori more or less likely to spread gradually. They use firm size and analyst coverage as their main sorting variables. Their central prediction is that stocks with slower information diffusion should exhibit more pronounced momentum. Their sample period is 1980 – 1996 and it includes NYSE, AMEX and NASDAQ stocks, excluding ADRs, REITs, closed-end funds and stocks that do not have a CRSP share type code of 10 or 11. Their results indicate that once one moves past the very smallest stocks, the profitability of momentum strategies decline sharply with firm size. They also find that holding size fixed momentum strategies work better among stocks with low analyst coverage and the effect of analyst coverage is greater for stocks that are past losers than past winners, i.e. low analyst coverage stocks seem to react more sluggishly to bad news than good news. Their findings give empirical support to the Hong and Stein (1999) model, however they conclude that alternative interpretations of some or all of the evidence are possible and more research is needed.

Lee and Swaminathan (2000) study the relationship of price momentum and trading volume. They investigate the usefulness of trading volume in predicting cross-sectional returns for various price momentum portfolios. Their sample consists of all firms listed on the NYSE and AMEX during January 1965 – December 1995 with at least two years of data prior to the portfolio formation date. Primes, closed-end funds, REITs, ADRs and foreign companies are excluded from the sample. Their results indicate that information content of trading volume is related to market misperceptions of firms' future earnings prospects. Specifically, they provide evidence that low (high) volume stocks tend to be under- (over) valued by the market. In addition, they show that price momentum phenomenon eventually reverses and that the timing of this reversal is predictable based on past trading volume. They also argue that existing investor behaviour theories e.g. Barberis et al. (1998) should be altered as they don't explicitly incorporate trading volume and therefore cannot explain why trading volume is able to predict the magnitude and persistence of future price momentum.

Jegadeesh and Titman (2001) study various explanations for the profitability of momentum strategies first presented by Jegadeesh and Titman (1993). They test both the behavioural models of Barberis et al. (1998), Daniel et al. (1998) and Hong and Stein (1999) and the risk-

based model by Conrad and Kaul (1998). In addition, they expand their original data set by eight extra years in order to test whether the original findings were due to data snooping and whether the phenomenon exists after their initial findings. Their sample includes all stocks traded on the New York Stock Exchange, American Stock Exchange and NASDAQ. They exclude all stocks priced below $5 at the beginning of the holding period and all stocks with market capitalizations that would place them in the smallest NYSE decile to ensure that the results are not driven by primarily small and illiquid stocks. Their results indicate that momentum profits in the eight years subsequent to the Jegadeesh and Titman (1993) sample period are very similar to the profits found in the earlier time period. This evidence gives some assurance that the momentum profits are not entirely due to data snooping biases. Their findings are against Conrad and Kaul (1998) risk model but they are in line with the behavioural models. However, they point out that the evidence supporting the behavioural models should be tempered with caution.

Chordia and Shivakumar (2002) analyse the relative importance of common factors and firm specific information as sources of momentum profit. They predict stock returns using standard macroeconomic variables and then examine whether momentum is attributable to the predicted component or the firm specific component of returns. The macroeconomic variables they use are: lagged values of the value-weighted market dividend yield, default spread, term spread and yield on three-month T-bills. Their sample includes NYSE and AMEX stocks from July 1926 to December 1994. They find that profits to momentum strategies are explained by a parsimonious set of macroeconomic variables that are related to the business cycle. The evidence that they find is consistent with time-varying expected returns being a plausible explanation for stock momentum. Their results also suggest that the profitability of momentum payoffs arises form the cross-sectional differences in conditional expected returns. These findings are consistent with Berk et al. (1999) that profitability of momentum strategies represents compensation for bearing time-varying risk and, hence is consistent with rational pricing theories. They conclude that the results from their research provide a possible role for time-varying expected returns as an explanation for momentum payoff.

**Table 2: U.S. momentum returns explicated in the literature**

The first column reports the name/names of the publisher. The second column reports winner minus loser momentum returns for 6 month ranking period and 3, 6, 9 and 12 months holding periods respectively, except for Conrad and Kaul (1998) in which holding period and ranking period have an equal duration, i.e. 3 month column reports momentum return for 3 month ranking and holding periods and the same goes for 6, 9 and 12 months respectively. *** denote statistical significance at the 1% level. Weight column reports the weighting method used, EW stands for equally weighted, VW stands for value weighted and for WRRS all stocks are used to calculate momentum profits and they are weighted by their relative return with respect to the market average. Percentage column reports the percentage size of the winner and loser portfolios, i.e. 10 means that winners are the top decile and losers are bottom.

| Publication | Momentum Return | | | | Sample Period | Weight | Percentage |
|---|---|---|---|---|---|---|---|
| | 3 month | 6 month | 9 month | 12 month | | | |
| Jegadeesh and Titman (1993) | 0.840*** | 0.950*** | 1.020*** | 0.860*** | 1965 - 1989 | EW | 10 |
| Conrad and Kaul (1998) | 0.027 | 0.360*** | 0.708*** | 0.701*** | 1962 - 1989 | WRRS | N/A |
| Moskowitz and Grinblatt (1999) | N/A | 0.430*** | N/A | N/A | 1963 - 1995 | VW | 30 |
| Hong et al. (2000) | N/A | 0.527*** | N/A | N/A | 1980 - 1996 | EW | 30 |
| Lee and Swaminathan (2001) | 1.040*** | 1.050*** | 1.080*** | 0.880*** | 1965 - 1995 | EW | 10 |
| Jegadeesh and Titman (2001) | N/A | 1.230*** | N/A | N/A | 1965 - 1998 | EW | 10 |
| Chordia and Shivakumar (2002) | N/A | 0.730*** | N/A | N/A | 1963 - 1994 | EW | 10 |
| Griffin et al. (2003) | N/A | 0.590*** | N/A | 0.040 | 1927 - 2000 | EW | 20 |

*Momentum in REITs' shares*

Chui, Titman and Wei (2003a) study the momentum phenomenon in REIT market. Their sample includes an average of 68 REITs from February 1983 to June 1999 and benchmark group of common stocks, with an average number of 4921 from the same time period. They study whether there exits momentum phenomenon in an intra-industry setting, and they also test the investor overconfidence theory of Daniel et al. (1998) and the information diffusion theory of Hong and Stein (1999) as a source of momentum profits. They argue that the first theory predicts stronger momentum phenomenon in REITs during the post-1990 period than during the pre-1990 period due to more valuation uncertainty in the post-1990 period. The increased valuation uncertainty was due to the changes in REIT legislation in 1990, which allowed a so called Umbrella Partnership REIT (UPREIT) Structure and the new legislation made the accounting statements of REITs more difficult to analyse and enabled them to build more complicated ownership structures. The Hong and Stein (1999) theory on the other hand predicts a more pronounced momentum phenomenon in REITs during the pre-1990 period than during the post 1990 period due to higher speed of information diffusion in latter period, this was due to the fact the in pre-1990 period REITs weren't as popular and they didn't receive as much analyst coverage than in the post 1990 period. They also use the Fama and French (1993) three factor model to study whether the momentum in REITs can be explained by the three risk factors. Their results indicate that first of all momentum strategy generates profit of 0,89% per month during the sample period and in addition they find that momentum

phenomenon is relatively small before 1990 but quite large after 1990, thus supporting the overconfidence theory of Daniel et al. (1998). Interestingly they don't find the same change in momentum profits from their common stock benchmark group, supporting the hypothesis that the structural changes REITs occurred in 1990 had an effect to the industry. They also show that momentum returns cannot be explained by factor risks, as measured by the Fama and French (1993) three factor model.

Glascock et al. (2003) study REIT momentum returns in different market states, and explain the momentum phenomenon with a risk-based dividend growth theory of Johnson (2002). According to that theory infrequent changes to business conditions, such as technology innovations and structural changes, cause persistent shocks to dividend growth rates and as a result, increased dividend growth rates cause momentum returns. They also hypothesise that REITs are defensive stocks, i.e. have lower volatility in bear markets. As a result REITs should generate higher momentum returns during downward markets than during upward markets. Their sample includes all the REITs which have monthly return data available from CRSP in the time period of 1972 to 2000. The average number of REITs in their sample during the period is 83. Their results indicate that momentum returns in REITs are significant, and they find an average monthly momentum return of 0,6% during the 1972 to 2000 period. They also find that momentum returns are higher during up market which is inconsistent with the predictions for defensive stock from the dividend growth theory of Johnson (2002). However, they find that consistent with the dividend growth theory prediction, winners' dividend/price ratios are higher than those of losers, and that conditioning on market states, momentum returns are positively correlated with the difference of winners' and losers' dividend/price ratios.

Chui, et al. (2003b) study the cross sectional determinants of expected REIT returns in the pre- and post- 1990 periods. Their sample includes all REITs which are traded on the NYSE, AMEX or NASDAQ over the period from 1985 to 2000. In the pre-1990 period the average number of REITs which they have in their sample is 36, and in post-1990 period 117. In their study, they find evidence of momentum phenomenon in the both time periods. However during the post-1990 period the momentum is much stronger than pre-1990 period. They also find that determinants of expected returns are different in the two subperiods: in the pre-1990 period high book-to-market REITs outperformed low book-to-market REITs, large REITs outperformed small REITs and REITs with analyst coverage outperformed REITs without

analyst coverage. However, during the post-1990 period momentum phenomenon was stronger but analyst coverage, size and book-to-market were not significantly related to REIT returns. What makes these findings interesting is that larger REITs had stronger momentum phenomenon than smaller REITs, whereas previous common stock studies have found opposite results, e.g. Hong et al. (2000).

**Table 3: U.S. REIT momentum returns explicated in the literature**

The first column reports the name/names of the publisher. The second column reports winner minus loser momentum returns for 6 month ranking period and 3, 6, 9 and 12 months holding periods respectively. ** and *** denote statistical significance at the 5% and 1% level respectively. Weight column reports the weighting method used, EW stands for equally weighted and VW value weighted. Percentage column reports the percentage size of the winner and loser portfolios, i.e. 30 means that winners are the top decile and losers are bottom.

| Publication | Momentum Return | | | | Sample Period | Weight | Percentage |
|---|---|---|---|---|---|---|---|
| | 3 month | 6 month | 9 month | 12 month | | | |
| Chui, Titman and Wei (2003a) | 0.780*** | 0.890*** | 0.640** | 0,360 | 1983 - 1999 | VW | 30 |
| Chui, Titman and Wei (2003b) | N/A | 0.984*** | N/A | N/A | 1985 - 2000 | VW | 30 |
| Glascock and Hung (2003) | N/A | 0.550*** | N/A | N/A | 1972 - 2000 | EW | 30 |

### 2.2.4 *Transaction costs*

The reported excess returns on momentum strategies are easily confused with momentum profits. In order to report attainable profits by investors, transactions costs must be taken into account. The literature on the momentum phenomenon has neglected to address the issue of transaction cost in detail for a long time. (Swinkels 2004)

Korajcyk et al. (2004) investigate the effect of trading costs, including price impact, on the profitability of particular momentum strategies. In particular, they estimate the size of a momentum-based fund that could be achieved before abnormal returns are either statistically insignificant or driven to zero. They investigate several trading cost models and momentum portfolio strategies and find that the estimated excess returns of some momentum strategies disappear after the initial investment of $4.5 to over $5.0 billion is engaged (by a single fund) in such strategies. The statistical significance of these excess returns disappears after $1.1 - $2.0 billion is engaged in such strategies. Therefore, transaction costs, in the form of spreads and price impacts of trades, do not fully explain the return persistence of past winner stocks exhibited in the data. They conclude that this anomaly remains an important puzzle.

Lesmond et al. (2004) examines the profitability of relative strength or momentum strategies (buying past strong performers and selling past weak performers). They find that the returns on those targets do not exceed trading costs. The magnitude of the trading costs associated with these momentum strategies is much larger than previously accepted, since the composition of standard relative strength portfolios is heavily weighted toward trading of particularly high transaction cost stocks. Moreover, large cross-sectional variation in relative strength returns is increasing in trading-cost proxies, suggesting that trading costs are binding to arbitrage. The existence of performance persistence patterns in returns does not appear to conflict with information efficiency or suggest the existence of arbitrage opportunity. Although their evidence casts doubt on the gains from any momentum strategy, they do not attempt to reject the profitability in all momentum strategies.

Transaction costs are important in momentum research as these strategies demand frequent trading. However, the magnitude of trading costs depends a lot from momentum strategy being used; e.g. weekly momentum strategy demands a lot more trading than monthly strategy. Thus, it is obvious that each strategy's transaction costs should be studied separately before one can make any arguments that trading costs erase the potential profits from momentum strategies. Nevertheless, as these strategies involve significant trading it is evident that trading costs will have significant influence on the momentum profits and that's why it is important to include them to the research.

## 2.3 REITs in mixed-asset portfolio

This section reviews the empirical literature of U.S. REITs' diversification benefits in a mixed-asset portfolio setting.

### *2.3.1 Empirical evidence about REITs in mixed-asset portfolios*

Lee and Stevenson (2005) study the benefits from adding REITs to mixed-asset portfolio in long and short run. They examine both the return enhancement possibilities and risk reduction benefits from adding REITs to a portfolio consisting of stocks and bonds. They constructed 20 portfolios with different risk-return characteristics, i.e. portfolio number 1 has the biggest risk and return and the portfolio 20 has the lowest risk and return, thus they want to study the effects along the efficient frontier. Their analysis includes S&P 500, Wilshire Mid-, Small- and Micro-Cap indices, U.S. Government bond indices (maturities 1-3, 3-5, 5-7, 7-10 and over 10 years) and in addition they used MSCI indices to proxy Asian and European equity

markets. Their sample period is from 1980 to 2002. They use various holding periods: 5, 10, 15 and 20 years. For each time period they calculate three efficient frontiers; one to which REITs are not allowed and for the remaining two they are. First, they estimate the initial optimal portfolio excluding REITs, then for the return enhancement tests they fix the variance of the initial portfolio and form new optimal portfolio to see whether REITs would be added to it and whether adding REITs would enhance returns. Then they do the same procedure but instead fix the return from the initial portfolio to see whether REITs would then enter the new optimal portfolio and whether adding them has any risk reduction benefits compared to the initial portfolio.

Their results indicate that first of all, REITs do provide diversification benefits to optimal portfolios across the investment horizons which are used. They also find that the benefits tend to increase as the investment horizon is extended, indicating that REITs may be more attractive to investors with longer holding periods. In addition they observe that the benefits from REITs appear to come from both the return enhancement and risk reduction. In the lower part of the efficient frontier REITs offer more return enhancement possibilities than risk reduction but this trend reverses when moving on the curve. The authors conclude that this is due to the fact that REITs are in between of stocks and bonds with respect to risk-return characteristics. In low risk part of the efficient frontier they enhance the returns compared to bonds but without the same risk level of stock. Compared to stocks they offer diversification benefits without the same level of return reduction compared to bonds.

Bleu and Olson (2003) study the return behaviour of REITs and stocks using monthly data from 1972 to 2001 to determine whether investors should consider adding REITs to traditional portfolio of stocks and bonds. They study the development of correlation coefficient between the equity REITs, mortgage REITs and stock returns during the sample period. They argue that if REITs are not highly correlated with stocks or, if this correlation has been declining over time, REITs can enhance the risk/return relationship of a general stock portfolio. They employ a dummy regression model in which they utilise three different dummy trend variables in order to find out how the correlations have developed during the sample period, i.e. they focus on periods 1976 – 2001, 1993 – 2001 and 2000 – 2001. Their results indicate that first of all equity REITs and mortgage REITs have quite high correlation (0.75) and its statistically significant at the 1% level. Also they find that mortgage REITs are more correlated to the S&P 500 than equity REITs, thus equity REITs offer more

diversification benefits. However, they conclude that equity investors can reduce the portfolio risk by including REITs to a portfolio of stocks and bonds and that the diversification effect of adding REITs in portfolio has increased over time.

Chandrashekaran (1999) study the ex-ante asset allocation situation in portfolio of REITs, stocks and bonds. The article explores times-series behaviour of REIT index returns to see if there are simple rules that may be used to form ex ante expectations of the returns on REITs. In addition he studies the patterns in volatility of the REIT index and correlations of REIT index with other asset classes to find out if these can be exploited for asset allocation purposes. The study uses returns on the S&P 500 index as the proxy for the stock market and returns on the Shearson-Lehman Government/Corporate Bond Index as the proxy for bond market returns. The sample period is 1975 – 1996. The main findings of this article are that first of all, REIT index variances and covariances with other asset classes decline after an upward move in the REIT index and increase after the a downward move in the index, thus REIT stocks may have an important role to play in dynamic asset allocation strategies. Secondly, the results indicate that dynamic asset allocation strategies that use conditioning information offer the promise of achieving mean-variance tradeoffs which are similar to those attained by fixed-weight unconditional mean-variance efficient portfolios that are constructed using ex-post means, variances and covariance's.

# 3 Hypotheses

This section presents the hypothesis for the study. They are divided into two parts: first, momentum related hypotheses will be elaborated and after that the hypotheses related to diversification benefits of REIT momentum and REIT long-only strategies will be elaborated. In addition to the traditional momentum profit related hypothesis, I also add hypothesis which refer to transaction costs and trading volume of momentum strategies. From these two hypotheses especially the trading volume is of special interest as it is new in the area of momentum research. The current literature has presented evidence according to which the strategies are profitable at least in an academic setup. Thus, the momentum research should start to focus more on the practical issues related to the subject as the question of momentum strategies' practical feasibility is still very much unanswered.

## 3.1 REIT momentum

*Momentum retuns*

Jegadeesh and Titman (1993 and 2001) among others have found positive abnormal monthly returns from momentum strategies from the general stock market when transaction costs are neglected. Similarly Chui, et al. (2003a and 2003b) have found positive abnormal monthly returns from momentum strategies from REIT stocks when transaction costs are excluded. As I follow the methodological approach of these studies, i.e. overlapping portfolio method, I hypothesize that there are positive momentum returns in REIT stocks in the whole sample period, when transaction costs are not taken into account.

**H1.** *There are positive momentum returns in REIT stocks when transaction costs are excluded*

This hypothesis is tested by dividing the REITs into winner and loser portfolios based on their historical performance (i.e. ranking period). Then a zero cost momentum portfolio is structured by buying the winner portfolio and short selling the loser portfolio for predetermined time period (i.e. holding period). 3, 6, 9 and 12 month ranking and holding period combinations along with 3 different cut-off points, i.e. 10%, 20% and 30% are tested. They sum up to total of 96 different individual momentum strategies, which are tested in order to find out the most profitable strategy. Also the potential effects of the bid-ask bounce are taken into account. Stocks which are thinly traded may experience fluctuations between the bid and ask quotes and bias the observed momentum profits. As REITs represent only one industry, it is likely that they are more thinly traded than the whole stock market in total on average; therefore it is important to take this fluctuation into consideration. This is done following the widely used[7] method of delaying the formation of the zero-cost momentum portfolio by one month after the ranking period. This lag should remove the potential effects on the bid-ask bounce and help the separation between successful momentum strategy and side effects of thin trading.

*Subperiod momentum returns*

The 2nd hypothesis is based on the Hong et al. (1999) information diffusion theory, which states that momentum profits are higher for stocks with slower information diffusion, e.g. small stocks and stocks with low analyst coverage. During the latter subperiod 1.1.2002 – 31.12.2007, the REIT market was more popular than in the former subperiod. This is due to

[7] See e.g. Jegadeesh and Titman (1993 and 2001)

the fact that according to the industry specialists after the IT bubble investors became more interested about REITs because they didn't want to invest in growth stocks or the infamous dotcoms so much anymore, thus the popularity of REITs increased a lot in the investor community[8]. This can also be seen e.g. from the strong increase in the institutional ownership in REIT stocks in latter subperiod from the table 6. Also, when looking at the REIT market capitalizations from figure 1, one can clearly see that it grew significantly more in latter subperiod than in the former subperiod. Based on this development and the Hong et al. (1999) information diffusion theory I argue that momentum returns should be bigger in the first subperiod compared to the second, as the information diffusion was slower in first period.

**H2.** *The momentum returns are stronger in first subperiod 1.1.1995 -31.12.2001*

The 2nd hypothesis is tested by dividing the 96 individual momentum strategies between the two subperiods (1.1.1995 – 31.12.2001 and 1.1.2002 – 31.12.2007) and analysing the returns of each strategy in order find evidence whether momentum returns are stronger in the first subperiod of 1995 – 2001.

*Momentum returns' relation to risk factors*

Current literature about the momentum effect has found evidence that momentum returns cannot be explained by traditional risk factors, i.e. Fama and French (1993) three factor model. However, it is important to gain more evidence of this issue and also test to what extent the factors are able to explain the momentum returns, thus I hypothesize that REIT momentum profits are not caused by the three risk factors of Fama and French (1993).

**H3.** *The success of momentum strategies are not explained by Fama and French (1993) risk factors*

This hypothesis is tested by utilising the Fama and French (1993) three factor model in explaining the momentum profits. The model includes a market factor, a size factor and book-to-market factor; it will be constructed following the Fama and French (1993) procedures.

*Transaction costs*

Transaction costs are a vital part in momentum research. Korajcyk et al. (2004) found that transaction costs have significant impact on the momentum profits but they don't fully

[8] See Gering (2004)

explain the return persistence of past winner stocks. On the other hand, Lesmond et al. (2004) examines the profitability of momentum strategies and find that the returns on those targets do not exceed trading costs. They argue that the magnitude of trading costs associated with momentum strategies is larger than previously accepted, since the momentum strategies typically trade particularly high transaction cost stocks. Based on the evidence presented in these two papers and when considering the fact that REITs are not as liquid as the stock market in general i.e. they are more expensive to trade, I hypothesise that REIT momentum profits aren't robust of trading costs.

**H4.** *Momentum profits disappear when trading costs are taken into account*

The fourth hypothesis is tested by building a custom-made transaction cost model to which one way transaction cost estimates are implemented. These estimates are taken from two articles: Keim and Madhavan (1997) and Jones and Lipson (2001). Both articles have been able to estimate the total execution costs for institutional investors by using real trading data provided by the Plexus Group. What makes these two papers really practical for this study is that they have calculated several transaction cost estimates for momentum-trading strategies. Thus, these estimates can be considered applicable for this thesis. The effects of these estimates are then evaluated in order to find evidence whether the momentum profits also exists when transaction costs are taken into account.

*REIT momentum position size*

REITs represent only one industry, thus they are on average more illiquid than traditional stocks. Institutional investors, on the other hand usually have a great deal of assets under management[9], i.e. they want to trade big positions. If the potential REIT momentum positions are too small the institutional investors would not trade them, as they couldn't make profits big enough. Based on these facts I argue that the potential REIT momentum positions are too small for institutional investor's interest.

**H5.** *REIT momentum positions are too small for institutional investors*

The fifth hypothesis is studied by using a specific trading volume model build by the author. The model is able to estimate REIT momentum positions' monthly traded value. The monthly

[9] According to the SEC rule 13-f a specific entity has to manage at least $100 million in equity in order to be considered as an institutional investor.

estimates are derived from the daily figures which are calculated by multiplying the average of opening and closing prices with the daily volume. Then the daily values are summed up to derive an estimate for the monthly level. Then a single investor's share from the total momentum REIT traded volume is calculated by assuming that one investor could trade 1-5 % from the total value of momentum REITs. This assumption is based on the fact that the trader would only be able to trade a small fraction of the momentum REITs total value, otherwise he would wobble the prices which would increase trading costs, e.g. trough bid-ask spread and eliminate the momentum profits.

## 3.2 Diversification benefits

Portfolio's risk-return characteristics will improve if a new asset which is not perfectly correlated with the assets already in a portfolio is added to the portfolio, thus this diversification will decrease the unsystematic risk in the portfolio. After an extensive research Lee and Stevenson (2005) find that REITs provide diversification benefits to optimal portfolios across the investment horizons which are tested. They also find that the benefits from REITs appear to come from both the return enhancement and risk reduction benefits. Based on the diversification theory and the findings of Lee and Stevenson (2005) I hypothesise that REIT long-only and REIT momentum strategies will provide diversification benefits to investors.

**H6.** *Adding REIT momentum and REIT long-only strategies to a mixed-asset portfolio will improve the portfolio's total risk-return characteristics*

This hypothesis is tested by calculating the correlations between REIT momentum and REIT long-only strategies and some major stock and bond indices in order to find out whether these two strategies can improve the mixed-asset portfolio's total risk return characteristics. The development of the correlations trough time is also studied in order to find out if the correlation has varied a lot depending on the time period. Finally REIT momentum and REIT long-only strategies' performance is tracked in down markets; first during the 8 worst months of the S&P 500 stock index and the in the recession of 2001, thus it is important to see whether these two strategies can provide good returns when the market on average is experiencing a downturn.

**Table 4: Summary of hypothesis**

**REIT momentum**

**H1.** There are positive momentum returns in REIT stocks when transaction costs are excluded
**H2.** The momentum returns are stronger in the first subperiod 1.1.1995 - 31.12.2001
**H3.** The success of momentum strategies are not explained by Fama and French (1993) risk factors
**H4.** Momentum profits disappear when transaction costs are taken into account
**H5.** Reit momentum positions are too small for institutional investors

**Diversification benefits of REIT momentum strategies**

**H6.** Adding REIT momentum and REIT long only strategies to a mixed-asset portfolio will improve the portfolio's total risk-return characteristics

# 4 Data and methodology

The first subsection presents the detailed description of data being used in this study. The second subsection presents methodologies applied in this study, and it is further divided into momentum, Fama and French three factor model (1993), transaction cost model and trade volume model methodologies.

## *4.1 Data description*

The U.S. REITs were selected because of two reasons; first, U.S. financial markets are the largest and most developed in the world and also Real Estate Investment trusts have existed in U.S. for a long time already. In the U.S. there are also enough REITs to collect a good sample. The data set consists of the REITs which are traded in the New York Stock Exchange ("NYSE"), American Stock Exchange ("AMEX") and National Association of Securities Dealers Automated Quotations ("NASDAQ"). All REITs in the 3 exchanges are identified and ticker codes and REIT descriptions are collected by hand, by using the stock exchanges' websites. All non-REIT real estate related firms, e.g. plain real estate investment companies are excluded from the sample. This is done in order to narrow the focus of the research to REITs only. As described earlier, REITs have special requirements but they also enjoy certain privileges compared to e.g. plain real estate investment companies, thus it is important to concentrate purely on REITs. The complete alphabetical list of REITs used in this study along with ticker and RIC codes can be found from the Appendix 1. Next, monthly closing prices of DataStream total return index from each REIT is collected from time period 1.1.1995 – 31.12.2007. The DataStream total return index data is adjusted for splits and dividends, which is very important in case of REITs as they have to pay most of their earnings out as dividends, thus dividends represent a significant part of their yield. In addition, daily closing prices of

each REIT are acquired by using REUTERS 3000 Extra and REITs which have closing prices under $1 dollar are excluded from the sample. This is done because of two reasons: first, to avoid extremely illiquid REITs and secondly to remove the REITs from the sample in which even small absolute changes would create significant relative changes in the total return index.

The monthly returns used in the study are calculated by using logarithmic returns from the monthly total return index closing prices. The reason behind this is that first of all, in academic research logarithmic returns are typically used. Also as REITs represent only industry some of them might be traded fairly infrequently, thus using shorter time period would increase the problem of thin trading. In addition, Chui, Titman and Wei (2003) use monthly returns for studying medium-term momentum strategies, thus this better enables the comparison to the related literature.

The data set covers period from 1.1.1995 to 31.12.2007. This period was chosen because of two reasons; first to my best knowledge there haven't been any studies about REIT momentum phenomenon after the IT bubble, secondly the starting point was chosen so that there are enough REITs to form momentum portfolios. In practise the actual investing of momentum portfolios begins after a little lag which depends on the strategy, thus the strategies demand ranking period, e.g. 12 months in 12 month strategy. The sample period is also divided into 2 subperiods: 1.1.1995 – 31.12.2001 and 1.1.2002 – 31.12.2007. This is done in order to study the momentum phenomenon in changing environment, i.e. REITs becoming more popular in investor community during the second subperiod. Also during the sample period the U.S. economy experienced one of the biggest bull markets ever, i.e. the IT bubble, thus the data set enables to study the momentum also in different economic environments. This is especially interesting from the diversification benefits research point of view.

Table 5 presents the descriptive statistics of the sample. From the table 5 one can clearly see that the number of REITs in the sample has increased throughout the sample period. Interestingly, in 2002 – 2007 the growth rate has been a lot higher compared to earlier period of 1995 – 2001. This observation clearly supports the idea that after IT bubble REITs became more popular. In 1995, there are 80 REITs in the data set and in 2007 there are 146, thus yearly average number of REITs in the sample is approximately 108, which is enough to form

momentum portfolios and study the intra-industry momentum. The table presents the average institutional ownership data for the sample. It also gives clear evidence that the REITs have become more popular during the sample period. In 1995 the average institutional ownership is 48.17% compared to the 74.94% in 2007. As mentioned before, this clear transition allows the studying of Hong et al. (1999) information diffusion theory as a possible explanation to the momentum profits. The table 5 also shows the average annual equally weighted return of the sample. During the sample period REITs have performed very well, there are only 3 years which have negative returns. The negative return for the 2007 is driven by the credit crunch and the real estate recession in the U.S.

**Table 5: Descriptive statistics of the sample**

Sample period is 1.1.1995 – 31.12.2007. REITs are identified and collected from NYSE, NASDAQ and AMEX stock exchanges. Market capitalizations are acquired from Thompson ONE Banker. Equally weighted average yearly returns are calculated form the DataStream Total Return index, which is dividend and split adjusted assuming that dividends are reinvested. Average institutional holding percentages are acquired from the 13f filings of U.S. Securities and Exchange Commision by using Thompson ONE Banker.

| | Year | Number of REITs in the sample | Equally weighted average yearly return | Average institutional Ownership |
|---|---|---|---|---|
| First subperiod | 1995 | 80 | 19.87 % | 48.17 % |
| | 1996 | 84 | 30.87 % | 50.72 % |
| | 1997 | 85 | 16.11 % | 53.92 % |
| | 1998 | 94 | -16.90 % | 53.52 % |
| | 1999 | 103 | -6.82 % | 57.89 % |
| | 2000 | 105 | 22.65 % | 63.26 % |
| | 2001 | 105 | 23.31 % | 64.60 % |
| Second subperiod | 2002 | 106 | 6.39 % | 66.89 % |
| | 2003 | 108 | 39.90 % | 69.13 % |
| | 2004 | 116 | 13.29 % | 71.56 % |
| | 2005 | 132 | 14.09 % | 73.65 % |
| | 2006 | 138 | 25.35 % | 74.64 % |
| | 2007 | 146 | -35.34 % | 74.94 % |

In order to calculate the monthly traded value estimates, the daily trading volumes and opening and closing prices are acquired from Thomson ONE banker. Also the REIT descriptive statistics (market capitalizations, earning per share, debt to equity and debt to assets) are taken from the Thomson ONE banker and they are quarterly observations. The institutional ownership data is hand collected from each REIT from the 13F filings by using the Thomson ONE Banker. The ownership data consists of quarterly observations.

*13F Filings*

13F is a report filed by institutional investment managers regarding to the section 13(f) of the Securities Exchange Act of 1934. Institutional investment managers that use the United States

mail in the course of their business and that exercise investment discretion over $100 Million or more in section 13(f) securities must file form 13F. Congress passed the section 13(f) of the Securities Exchange Act in 1975 in order to increase the public availability of information regarding the securities holdings of institutional investors. Congress believed that this institutional disclosure program would increase investor confidence in the integrity of the U.S. securities market.[10]

The securities of the Section 13(f) include exchange-traded stocks, equity options, warrants, shares of closed-end investment companies, and certain convertible debt securities. Shares of open-end investment companies, i.e. mutual funds, are not included and therefore should not be listed on Form 13F. Shares of exchange-traded funds however are on the official list and should be reported[11]. The information of the 13F filing must include among other things:

- The issuer name of all Section(f) securities in alphabetical order;
- Description of the class of security listed (for example, common stock, put/call option, class A shares, convertible debenture);
- the number of shares owned; and
- the fair market value of the securities listed, as of the end of the calendar quarter.[12]

## 4.2 Methodology

The first subsection explains the methodology behind the momentum profit calculation in detail. Second subsection reviews the Fama and French (1993) three factor model, which is used to calculate the risk adjusted returns. Third subsection presents the transaction cost model and finally the fourth subsection presents the trading volume model.

### 4.2.1 Momentum

*Overlapping portfolio method*

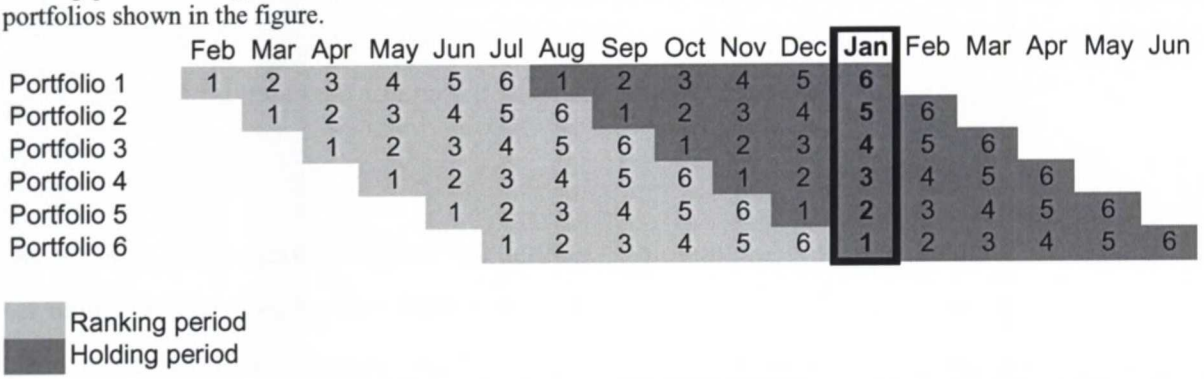
The momentum profits for different strategies are calculated by using the overlapping portfolio method which has been widely used in momentum research, e.g. Jegadeesh and Titman (1993). The method is as following: in any given month t, the momentum strategy holds a series of portfolios that are selected in the current month as well as in the previous K-1 months, where K is the holding period. Specifically, a strategy, which selects REITs on the

[10], [12] U.S. Securities and Exchange Commission, frequently asked questions about form 13F
[11] The official list of Section 13(f) securities can be found from http://www.sec.gov/divisions/investment/13flists.htm at the end of each quarter.

basis of returns over the past J months (ranking period) and holds them for K months (this is referred as J-month/K-month strategy) is constructed as follows: at the beginning of each month t the top x % and bottom x % of REITs, based on their performance in the past J months are calculated. Based on these calculations an equal weighted portfolio from the top x % is constructed, this is referred as the "winner portfolio", similarly an equal weighted "loser portfolio" is constructed from the bottom x % of REITs. In each month t, the strategy buys the winner portfolio and short sells the loser portfolio, holding this position for K months. In addition, the strategy closes out the position initiated in the t – K. Thus, under this strategy the weights on 1/K of the securities in the entire portfolio are revised in any given month. The momentum return calculated by using the overlapping portfolio method is simply an average of the running portfolios in each month. Reason for using this overlapping portfolio method is that then the overlapping returns can be avoided which potentially causes bias to the tests.

**Figure 6: Overlapping portfolio method with 6 month ranking and holding periods**

The figure shows visual presentation of momentum portfolio's return on January, when 6 month ranking and holding period strategy is used. The momentum return for January is simply an average of the 6 overlapping portfolios shown in the figure.




In this study the momentum strategies of 3, 6, 9 and 12 month holding periods are used. The same durations are also used for the ranking periods to find out which strategy is the best. Also potential effects of the bid-ask bounce are tested, by delaying the formation of portfolios for one month in between ranking and holding periods. This should remove any effects that the potential bid-ask bounce might have for the study. This phenomenon is especially interesting when studying intra-industry momentum, i.e. REITs. They represent only one industry, hence they might be affected by thin trading and bid-ask bounce. The winner and loser portfolios are constructed from the top and bottom 10 %, 20% and 30% of REITs. Thus, the effects of the different cut-off points are studied separately. The notation when describing individual momentum strategies is that "10/10" refers to the 10% cut-off points, "R6H6"

refers to 6 month ranking and holding periods, "(A)" refers to a strategy where the bid-ask bounce has not been taken into account and "(B)" refers to a strategy where bid-ask bounce has been taken into account.

### 4.2.2 Fama and French (1993) three factor model

In order to find out possible sources of momentum profits it is important to study whether the momentum returns are captured by any of the asset pricing models. For this purpose this study uses the Fama and French (1993) three factor model. The goal is to try to explain the returns with the model, so that there won't be any statistically significant positive alpha.

According to Fama and French (1993) the three factor model states that the expected return on a portfolio in excess of the risk free rate [$E(R_t) - R_f$] is explained by the sensitivity of its return to three factors: (i) the excess return on broad market portfolio ($R_m - R_f$); (ii) the difference between the return on as portfolio of small stocks and the return on a portfolio of large stocks (SMB, small minus big); and (iii) the difference between the return on a portfolio of high-book-to-market stock and the return on a portfolio of low-book-to-market stocks (HML, high minus low). Specifically, the expected excess return on portfolio i is,

$$E(R_i) - R_f = b_i\left(E(R_m) - R_f\right) + s_i E(SMB) + h_i E(HML) \qquad (7)$$

Where $E(R_m) - R_f$, E(SMB), and E(HML) are expected premiums, and the factor sensitivities or loadings, $b_i$, $s_i$ and $h_i$, are the slopes in the time series regression,

$$R_i - R_f = \alpha_i + b_i\left(R_m - R_f\right) + s_i SMB + h_i HML + \varepsilon_i \qquad (8)$$

### 4.2.3 Transaction cost model

*Background*

Transaction costs are a key issue in momentum strategies. As has been previously demonstrated momentum portfolios are trading intensive, e.g. strategy with 3 month holding period turns the portfolio over completely in every three months. Thus, in order for a momentum strategy to have any practical significance, it would have to be profitable also when transaction costs are included. Interestingly, as was pointed out in the literature review,

the momentum literature has not yet studied the issue thoroughly, i.e. there aren't many studies which explicitly try to find out whether momentum strategies are profitable when transaction costs are taken into account. One of the reasons for the lack of research in momentum transaction cost area is the great degree of difficulty concerning the subject. The biggest challenge is to come up with good estimates of transaction costs before one can implement them to a momentum strategy's profitability estimation.

Typically trading costs consists of two components, spread and broker commissions. Spread means that when buy or sell order is initiated at certain price there might not be enough buyers or sellers in market place so that the transaction could be executed at the price level the buyer or seller wants, i.e. the price either increases or decreases, thus causing more costs to the trader. This is especially the case with illiquid instruments and/or big orders. The spread is measured by the difference between the bid and ask prices, i.e. the bid-ask spread. However, Jones and Lipson (2001) argue that actually the traditional spread measures do not take into account all of the costs associated with the different trading strategies and in particular establishing position of using multiple transactions is likely to move prices adversely, increasing the total cost of establishing the position.

Jones and Lipson (2001) are able to overcome this challenge and come up with estimates for the total execution cost for institutional investor by using dataset provided by the Plexus Group. The company is a consulting firm that works with institutional investors to monitor and reduce their trading costs, their clients manage over $1.5 trillion in equity assets. Plexus group has also access to trading records of 25% of U.S. marketplace volume. Their dataset consists of 386 487 orders executed for Plexus clients in 1271 NYSE stocks. Jones and Lipson (2001) calculate transaction cost estimates for momentum, value and index trading strategies. They also compute estimates before and after NYSE changed most of its stocks minimum price increment from eights to sixteenths, this change occurred in June 1997. Interestingly they found that total execution cost for each strategies rose after the change. The increase is biggest for trades which demand liquidity, e.g. large orders and momentum transactions. Their findings give more evidence about the significance of the transaction costs in momentum research, thus the execution costs of momentum strategies are the largest of all trading types studied in Jones and Lipson (1997).

Keim and Madhavan (1997) use also dataset provided by the Plexus Group. Their data set consists of order level data and includes $83 billion worth of transactions. By studying the dataset they are able to come up with estimates for the total execution costs for institutional investor in NYSE, AMEX and NASDAQ. Keim and Madhavan (1997) also calculate estimates for value, technical i.e. momentum and index trading strategies. Interestingly, they also compute estimates for buyer and seller initiated trading. They also find that momentum trading has the highest individual execution costs, this finding is in line with previously mentioned Jones et al. (1997). They also find that the total execution costs are closely linked to the market liquidity, i.e. more illiquid stocks have higher execution costs. This finding gives more evidence about the significance of transaction costs in an intra industry study, i.e. REIT are not as liquid as stocks in general, thus one can conclude that the transaction costs have to be taken into account before the "true" profitability of REIT momentum strategies can be evaluated.

This study aims at the testing the momentum profits' robustness of momentum profits by following a three-phase methodology. First, the transaction cost estimates are acquired from two articles (Jones and Lipson (2001), Keim and Madhavan (1997)). Second, the selected execution cost estimates are implemented to special transaction cost model constructed by the author and third, the effects of selected transaction cost levels are studied in order to find evidence which levels act as break even costs for the momentum strategies and how likely it is that an investor would be able to trade under those levels in real life, i.e. the momentum strategy would be profitable. It is almost impossible to come up with accurate "true" REIT momentum transaction cost estimates, but by following the previously mention three phase methodology, reliable evidence about the break even cost levels can be acquired.

*Transaction cost model*

The formal transaction cost model can be stated as following:

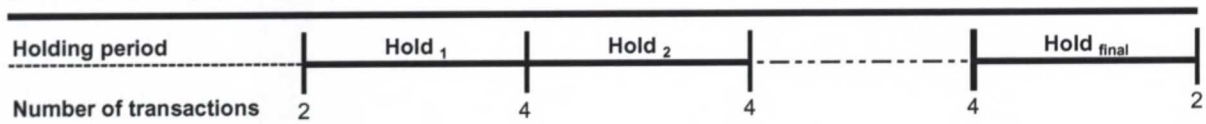
$$R_{T_{Trans}} = \frac{X*(1-T)*(1+R_t)}{X} - 1 \qquad (9)$$

Where, $R_{T_{Trans}}$ is the monthly return from the momentum portfolio after transaction costs, X is investment to the momentum portfolio, T is one way total execution cost and $R_t$ is the monthly

return of the momentum portfolio before transaction costs. The model assumes that the selected transaction cost estimate is constant, i.e. same for all trades. This is only a minor deficiency as the cost estimates are calculated from individual trade data, thus presenting reliable estimates of average total execution costs. Also the model is used to come up with evidence about average break even cost level, thus it is applicable for this purpose.

Figure 7 highlights the transaction cost logic in momentum strategies. In the beginning of the first holding period there are two transactions, i.e. opening of the long position in the winners and the short position in the losers. After that there are always 4 transactions in total in between holding periods, i.e. closing the 2 positions running which are opened in the previous holding period and opening of the 2 new positions. In the end of the last holding period there are again 2 transactions, i.e. closing the 2 running positions which are opened the beginning of that holding period. Figure 7 presents the heavy trading intensity that the momentum strategy has, thus it is important to include it the momentum study. For example three month holding period strategy turns the portfolio over in every three months, i.e. 4 times per year.

**Figure 7: The transaction cost frequency in momentum strategies**
The figure presents the number of transaction in the momentum strategy between holding periods. In the beginning there are 2 transactions, i.e. buying winners and selling losers. After that there are 4 transactions between holding periods, i.e. closing the positions held in previous holding period and opening new positions for the new holding period. In the end of the final holding period there are again 2 transactions as the final two positions, i.e. long on winners and short on losers are closed.




### 4.3.4 *Trading volume model*

Trading volume is another key aspect when examining the REIT momentum strategies' possible practical significance. REITs represent only one industry, thus REIT momentum strategies have a lot smaller total trading volume compared, e.g. momentum strategy focusing on the entire stock market. As has been previously demonstrated, momentum strategies demand lots of trading, i.e. the trading volume most likely creates constraint to the strategy, either by limiting the position sizes which an institutional investor could trade or by showing evidence that the momentum strategy couldn't be executed at all in real life setting.

The idea is find out how big of a portfolio could one institutional investor trade when implementing momentum strategy to U.S. REITs. For this purpose a specific trading volume model is constructed by the author. The model can be formally stated as following:

$$REITtotvol_{X_i} = \sum_{j=1}^{n} REITvol_{X_{i,j}} * \frac{(OPEN_{X_{i,j}} + CLOSE_{X_{i,j}})}{2} \Big| REIT_{X_i} \in REIT_{momentum_i} \quad (10)$$

Where, $REITtotvol_{X_i}$ is REIT x's total traded volume in month i, $REITvol_{X_{i,j}}$ is REIT x's trading volume in month i and trading day j, $OPEN_{X_{i,j}}$ is the opening price of REIT x in month i and trading day j, $CLOSE_{X_{i,j}}$ is the closing price of REIT x in month i and trading day j, $REIT_{X_i}$ is REIT x in month i and $REIT_{momentum_i}$ is the momentum portfolio in month i.

Idea in the model is to conduct an ex-post estimation of the total traded volume of the REITs which are selected to the momentum portfolios. What this means in practice is that if REIT x is selected to the momentum portfolio in month i, then the REIT x's traded volume in that month is calculated by multiplying the number of stocks traded by the averages of the open and closing prices and this procedure is done on the daily level, i.e. using daily prices and trading volumes. The values are then summed up to come up with an estimate for the total traded volume of REIT x in month i. It's important to use traded volume as the estimate as then the size of the momentum portfolio in terms off capital can be estimated. Unfortunately the traded volume is not reported by any of the data suppliers, e.g. Thomson ONE Banker, thus the value has to be estimated by the author.

After the total traded volume is calculated for all the REITs in the momentum portfolios for the sample period, the size of the single investor's momentum portfolio is calculated by assuming that one investor could trade a position between 1-5% from the total momentum REIT traded volume. This is pretty conservative estimate but in this case it is justified as REITs are pretty illiquid, one has to assume that single investor could not trade big position in that market without seriously affecting the prices. Also the issue of bid-ask spread which was discussed earlier would have implications if one would assume that single investor could trade big positions in illiquid market.

The shortcoming of the model is naturally that it assumes that the trades are executed at the average price. In reality this isn't the case as some trades are executed at a lower price and some at a higher price. However, as the size of the single trader's position from the total momentum REIT volume is already an estimate, the model provides good approximation which can be used to studying the potential size of a REIT momentum portfolio.

To my best knowledge this model is unique in terms of that it's the first ever attempt to come up with an estimate for the total position size for an institutional investor following REIT momentum strategy; i.e. if a certain hedge fund would launch REIT momentum strategy how big positions could it be able to trade. This is the true robustness test for the momentum strategy's profitability. Even though REIT momentum strategy would be profitable after transaction costs, also the position sizes would have to be taken into account in order to test the true robustness and practical feasibility of REIT momentum strategies.

# 5 Results and analysis

This chapter presents and analyses the empirical parts of the study. Section 5.1 presents the momentum returns and related empirical results. Section 5.2 presents robustness check for the momentum profits, by examining the effects of transaction costs to the momentum profits and estimating the potential size of REIT momentum positions. Finally section 5.3 presents the empirical evidence of adding REIT long-only and REIT momentum strategies to a mixed-asset portfolio.

## *5.1 Momentum returns*

First subchapter presents the raw returns for the momentum strategies. Second subchapter presents the comparisons and key findings of the raw returns. Third subchapter presents the risk adjusted returns, i.e. the Fama French (1993) three factor model alphas. Fourth subchapter presents the raw returns for two subperiods. Finally fifth subchapter presents the momentum REIT characteristics.

### *5.1.1 Raw returns*

*10/10 Strategy*

Table 6 presents the results for the momentum strategies which use the most extreme observations. The cut-off point for determining the winners and losers is 10%, i.e. the

momentum portfolios consist of REITs which are in the top or bottom 10 % after the ranking period. As previously mentioned, the momentum portfolios are zero cost as the top performers are bought and bottom performers sold short after the ranking period.

All of the 10/10 momentum portfolios have positive returns and also most of them are statistically significant even at the 1% level. Many of the individual t-statistics are very large, thus supporting the hypothesis that momentum profits do exist in REIT industry. However, the only returns which aren't statistically significant are the ones with 3 month holding period. This could be due to the fact that the 3-month strategies trade very often compared to other strategies, i.e. there could be more volatility in the returns and thus the t-statistic is lower. However, also all the strategies with 3 month holding period have positive returns, some even extremely positive, thus the momentum effect exists also in the 3 month holding period cases.

Also another interesting finding is that the returns in Panel B are higher than Panel A indicating that the momentum strategies which account for the bid-ask bounce perform better than the ones which don't. This finding is in line with related literature, e.g. Jegadeesh and Titman (1993) have found similar patterns in momentum returns. The table also shows how none of loser portfolios have negative returns but they are significantly lower than the winner portfolios' return, thus generating abnormal positive returns for the total momentum portfolio.

**Table 6: Monthly average momentum profits for 10/10 strategy**

The momentum portfolios are formed based on the return of REITs in the last J-months and are held for K-months. The values of J and K for different strategies are indicated in the first column and first row. The REITs are ranked based on their J-month return and top 10 % of REITs are bought and bottom 10 % sold to form the zero cost momentum portfolio. The average monthly returns of these portfolios are presented in the table. The momentum portfolios in Panel A are formed right after the ranking period returns are calculated. The momentum portfolios in Panel B are formed one month after the lagged returns are measured, thus to avoid the possible effects of the bid-ask bounce. T-statistics are in Italics. * and *** mark the statistical significance at the 10% and 1 % level respectively.

| | | Panel A | | | | Panel B | | | |
|---|---|---|---|---|---|---|---|---|---|
| Ranking period | | Holding Period (K) | | | | Holding Period (K) | | | |
| (J) | Porfolio | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 |
| 3 | Loser | 0.90 % | 0.69 % | 0.54 % | 0.67 % | 0.76 % | 0.46 % | 0.50 % | 0.70 % |
| | Winner | 1.19 % | 1.08 % | 1.13 % | 1.13 % | 1.51 % | 1.30 % | 1.20 % | 1.17 % |
| | **Winner - Loser** | **0.30 %** | **0.39 %** * | **0.59 %** *** | **0.45 %** *** | **0.76 %** | **0.84 %** *** | **0.71 %** *** | **0.46 %** *** |
| | (T-stat) | *0.49* | *1.76* | *14.83* | *14.83* | *1.32* | *2.66* | *7.13* | *11.67* |
| 6 | Loser | 0.48 % | 0.35 % | 0.30 % | 0.52 % | 0.33 % | 0.12 % | 0.28 % | 0.52 % |
| | Winner | 1.35 % | 1.29 % | 1.25 % | 1.19 % | 1.50 % | 1.34 % | 1.23 % | 1.17 % |
| | **Winner - Loser** | **0.88 %** | **0.94 %** *** | **0.95 %** *** | **0.67 %** *** | **1.16 %** * | **1.21 %** *** | **0.95 %** *** | **0.65 %** *** |
| | (T-stat) | *1.33* | *3.25* | *4.98* | *9.33* | *1.80* | *2.89* | *5.33* | *7.72* |
| 9 | Loser | 0.17 % | 0.14 % | 0.28 % | 0.42 % | 0.07 % | 0.13 % | 0.30 % | 0.47 % |
| | Winner | 1.40 % | 1.29 % | 1.22 % | 1.16 % | 1.47 % | 1.28 % | 1.18 % | 1.12 % |
| | **Winner - Loser** | **1.23 %** | **1.15 %** *** | **0.94 %** *** | **0.74 %** *** | **1.39 %** * | **1.14 %** *** | **0.88 %** *** | **0.65 %** *** |
| | (T-stat) | *1.30* | *3.41* | *5.67* | *7.88* | *1.71* | *3.71* | *4.96* | *6.19* |
| 12 | Loser | 0.07 % | 0.16 % | 0.20 % | 0.27 % | 0.13 % | 0.12 % | 0.22 % | 0.30 % |
| | Winner | 1.50 % | 1.32 % | 1.26 % | 1.20 % | 1.51 % | 1.34 % | 1.23 % | 1.16 % |
| | **Winner - Loser** | **1.42 %** | **1.15 %** *** | **1.06 %** *** | **0.93 %** *** | **1.38 %** * | **1.22 %** *** | **1.01 %** *** | **0.87 %** *** |
| | (T-stat) | *1.48* | *5.34* | *6.69* | *7.98* | *1.80* | *4.13* | *5.85* | *7.16* |

*20/20 Strategy*

Table 7 presents the results for momentum strategies which have 20 % as the cut-off point when determining the winners and losers, i.e. the momentum portfolio consist of REITs which are in the top or bottom 20 % after the ranking period. Naturally in this case the portfolio is bigger compared to the 10/10 case, i.e. there are more REITs in the momentum portfolio. This issue will be studied in detail in the upcoming trading volume chapter.

All 20/20 momentum strategies have positive returns and most of them are statistically significant even at the 1 % level. As was the case also with 10/10 strategy the 20/20 strategy also has large t-statistics which again support the hypothesis that momentum profits exist in the REIT industry. In the 20/20 strategy the returns are more statistically significant compared to the 10/10 strategy, i.e. there is only one individual strategy which is not statistically significant. This finding supports the hypothesis that the 10/10 strategy's returns are more volatile compared to 20/20 strategy, thus decreasing the t-statistics. This idea is also in line with intuition, as the 10/10 strategy uses more extreme observations than the 20/20 strategy, thus it is evident that those returns have more volatility, which leads to smaller t-statistics in the 10/10 strategy. Also in this strategy the returns in Panel B are higher than in Panel A, thus

indicating that strategies which take the bid-ask bounce into account perform better. As mentioned previously this finding is in line with earlier research.

**Table 7: Monthly average momentum profits for 20/20 strategy**

The momentum portfolios are formed based on the return of REITs in the last J-months and are held for K-months. The values of J and K for different strategies are indicated in the first column and first row. The REITs are ranked based on their J-month return and top 20 % of REITs are bought and bottom 20 % sold short to form the zero cost momentum portfolio. The average monthly returns of these portfolios are presented in the table. The momentum portfolios in Panel A are formed right after the ranking period returns are calculated. The momentum portfolios in Panel B are formed one month after the lagged returns are measured, thus to avoid the possible effects of the bid-ask bounce. T-statistics are in Italics. *, ** and *** mark the statistical significance at the 10%, 5% and 1 % level respectively.

| | | Panel A | | | | Panel B | | | |
|---|---|---|---|---|---|---|---|---|---|
| Ranking period | | Holding Period (K) | | | | Holding Period (K) | | | |
| (J) | Porfolio | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 |
| 3 | Loser | 0.93 % | 0.86 % | 0.75 % | 0.81 % | 0.77 % | 0.66 % | 0.70 % | 0.83 % |
| | Winner | 1.07 % | 1.04 % | 1.11 % | 1.11 % | 1.30 % | 1.20 % | 1.16 % | 1.13 % |
| | **Winner - Loser** | **0.14 %** | **0.19 % *** | **0.36 % *** | **0.30 % *** | **0.53 % **** | **0.54 % *** | **0.47 % *** | **0.30 % *** |
| | (T-stat) | *0.43* | *1.88* | *6.54* | *17.84* | *2.26* | *5.11* | *12.28* | *14.00* |
| 6 | Loser | 0.67 % | 0.58 % | 0.56 % | 0.70 % | 0.50 % | 0.43 % | 0.57 % | 0.70 % |
| | Winner | 1.19 % | 1.18 % | 1.18 % | 1.13 % | 1.34 % | 1.24 % | 1.18 % | 1.11 % |
| | **Winner - Loser** | **0.52 % *** | **0.60 % *** | **0.62 % *** | **0.43 % *** | **0.84 % *** | **0.81 % *** | **0.62 % *** | **0.41 % *** |
| | (T-stat) | *1.87* | *5.61* | *9.64* | *12.69* | *2.81* | *5.03* | *11.04* | *9.62* |
| 9 | Loser | 0.61 % | 0.51 % | 0.57 % | 0.64 % | 0.43 % | 0.45 % | 0.58 % | 0.64 % |
| | Winner | 1.28 % | 1.24 % | 1.17 % | 1.12 % | 1.38 % | 1.26 % | 1.15 % | 1.11 % |
| | **Winner - Loser** | **0.68 % *** | **0.73 % *** | **0.60 % *** | **0.48 % *** | **0.94 % *** | **0.81 % *** | **0.57 % *** | **0.47 % *** |
| | (T-stat) | *1.92* | *5.80* | *7.63* | *9.06* | *3.33* | *5.37* | *7.13* | *7.64* |
| 12 | Loser | 0.49 % | 0.48 % | 0.52 % | 0.55 % | 0.44 % | 0.43 % | 0.50 % | 0.55 % |
| | Winner | 1.27 % | 1.20 % | 1.15 % | 1.11 % | 1.35 % | 1.20 % | 1.12 % | 1.07 % |
| | **Winner - Loser** | **0.78 % **** | **0.71 % *** | **0.63 % *** | **0.55 % *** | **0.91 % *** | **0.77 % *** | **0.62 % *** | **0.52 % *** |
| | (T-stat) | *2.48* | *6.56* | *8.08* | *9.35* | *2.84* | *4.80* | *6.93* | *8.10* |

*30/30 strategy*

Table 8 presents the results for the 30/30 momentum strategy. These momentum portfolios are constructed so that after the ranking period, the top 30% of the REITs are winners and bottom 30% are losers, thus winners are bought and losers sold short in forming the zero cost momentum portfolios. This strategy has the biggest number of REITs in the portfolio as it invests to 60% of the total REIT sample, meaning that the investor would obviously be able to trade biggest position by using this strategy.

30/30 strategies have also all positive returns and most of them are statistically significant even at the 1% level. As was the case also the previous strategies, the 30/30 strategy also has high individual t-statistics, supporting the hypothesis that momentum profits exist in the REIT industry. The t-statistics in the 30/30 strategy are again higher compared to the 10/10 strategy; this finding gives more evidence to the previously discussed hypothesis that the momentum profits in the 10/10 strategy are the most volatile, i.e. have smallest t-statistics. Also in the

30/30 strategy the returns in panel B are higher than panel A indicating that strategies which take bid-ask bounce into account perform better.

**Table 8: Monthly average momentum profits for 30/30 strategy**

The momentum portfolios are formed based on the return of REITs in the last J-months and are held for K-months. The values of J and K for different strategies are indicated in the first column and first row. The REITs are ranked based on their J-month return and top 30 % of REITs are bought and bottom 30 % sold short to form the zero cost momentum portfolio. The average monthly returns of these portfolios are presented in the table. The momentum portfolios in Panel A are formed right after the ranking period returns are calculated. The momentum portfolios in Panel B are formed one month after the lagged returns are measured, thus to avoid the possible effects of the bid-ask bounce. T-statistics are in Italics. ** and *** mark the statistical significance at the 5% and 1 % level respectively.

| | | Panel A | | | | Panel B | | | |
|---|---|---|---|---|---|---|---|---|---|
| Ranking period | | Holding Period (K) | | | | Holding Period (K) | | | |
| (J) | Porfolio | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 |
| 3 | Loser | 0.97 % | 0.90 % | 0.83 % | 0.87 % | 0.83 % | 0.75 % | 0.78 % | 0.88 % |
| | Winner | 1.00 % | 1.03 % | 1.10 % | 1.10 % | 1.20 % | 1.16 % | 1.16 % | 1.11 % |
| | **Winner - Loser** | **0.02 %** | **0.12 %** ** | **0.28 %** *** | **0.23 %** *** | **0.37 %** ** | **0.41 %** *** | **0.37 %** *** | **0.23 %** *** |
| | (T-stat) | *0.12* | *2.02* | *7.73* | *18.43* | *2.50* | *6.81* | *15.58* | *17.48* |
| 6 | Loser | 0.79 % | 0.71 % | 0.72 % | 0.82 % | 0.65 % | 0.65 % | 0.71 % | 0.80 % |
| | Winner | 1.13 % | 1.10 % | 1.14 % | 1.10 % | 1.26 % | 1.26 % | 1.14 % | 1.09 % |
| | **Winner - Loser** | **0.34 %** ** | **0.39 %** *** | **0.42 %** *** | **0.28 %** *** | **0.60 %** *** | **0.60 %** *** | **0.43 %** *** | **0.29 %** *** |
| | (T-stat) | *2.08* | *6.40* | *10.85* | *11.65* | *3.51* | *6.14* | *12.01* | *9.34* |
| 9 | Loser | 0.72 % | 0.65 % | 0.69 % | 0.75 % | 0.59 % | 0.60 % | 0.68 % | 0.74 % |
| | Winner | 1.16 % | 1.14 % | 1.12 % | 1.09 % | 1.26 % | 1.19 % | 1.11 % | 1.08 % |
| | **Winner - Loser** | **0.44 %** ** | **0.49 %** *** | **0.43 %** *** | **0.35 %** *** | **0.66 %** *** | **0.59 %** *** | **0.43 %** *** | **0.33 %** *** |
| | (T-stat) | *2.32* | *8.42* | *9.08* | *9.87* | *4.16* | *7.00* | *8.35* | *8.34* |
| 12 | Loser | 0.67 % | 0.64 % | 0.68 % | 0.70 % | 0.64 % | 0.61 % | 0.67 % | 0.69 % |
| | Winner | 1.19 % | 1.10 % | 1.07 % | 1.04 % | 1.24 % | 1.12 % | 1.04 % | 1.03 % |
| | **Winner - Loser** | **0.52 %** ** | **0.47 %** *** | **0.39 %** *** | **0.34 %** *** | **0.59 %** *** | **0.51 %** *** | **0.37 %** *** | **0.34 %** *** |
| | (T-stat) | *2.50* | *5.45* | *7.44* | *8.39* | *2.84* | *4.11* | *6.10* | *7.39* |

### *5.1.2 Comparison and key findings of the raw returns*

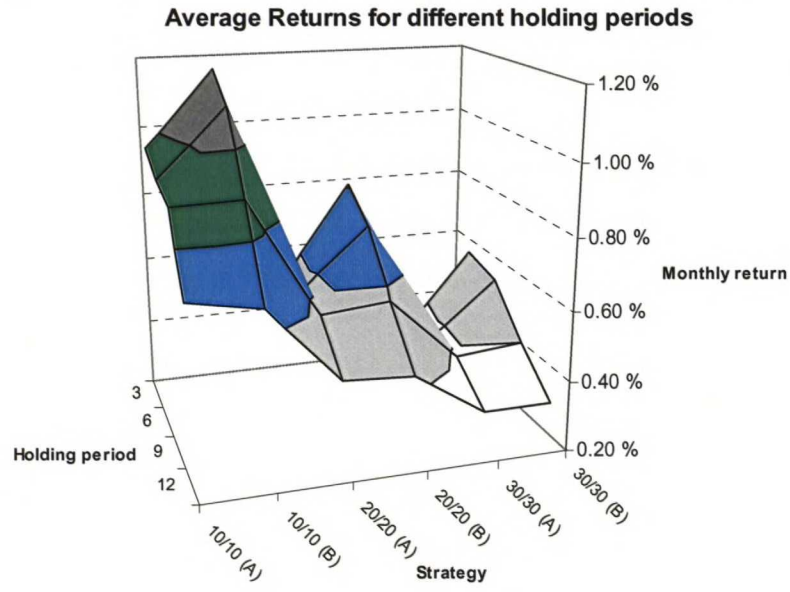
Now the three momentum strategies are compared and also some findings which can be seen by looking at the three tables about momentum returns are elaborated. In total the tables contain 96 different strategies, so in order to highlight the main issues I'm going to use three figures, 8, 9 and 10.

*Holding period*

Figure 8 presents the average monthly momentum returns for different holding periods. It is calculated by taking the average returns for 3, 6, 9 and 12 month holding period returns. The procedure is repeated for each strategy with and without the bid-ask bounce, i.e. there are 6 different strategies in total. Strategies which have "(A)" don't take the bid-ask bounce into account and strategies which have "(B)" accommodate it by placing a one month lag between ranking and holding periods. The idea is show what holding periods provide the best returns and which strategies are the most profitable.

**Figure 8: Average monthly momentum returns for different holding periods**

The returns presented in the figure are averages from the different ranking periods by keeping the holding period constant, i.e. the return for holding period 3 is the average of 4 individual returns (3 month holding and 3, 6, 9 and 12 month ranking period returns), which each have 3 month holding periods. The same procedure is done for the 3 different cut-off point strategies, i.e. 10/10, 20/20 and 30/30. The returns which have the lag between ranking and holding periods, i.e. take the bid-ask bounce into account are market by "(B)" and the returns without the lag are marked by "(A)", i.e. in total there are 6 different strategy combinations.




There are several interesting findings which can be seen from the figure 8. First of all, shorter holding periods have bigger returns than longer holding periods. This can be seen by looking each strategy's "line" in the figure; it is highest at the 3 month holding period level and comes down as the holding period increases. Second interesting observation is that, all else equal 10/10 is the best; 20/20 is the 2nd best and 30/30 is the 3rd best strategy. Third finding which can be observed from the figure 8 is that the strategies which take bid-ask bounce into account have higher returns than strategies which don't. This can be seen by comparing the returns of "(A)" and "(B)" within the same cut-off point strategy in the figure; "(B)" strategies clearly have higher returns compared to the "(A)".

There are some potential explanations for these findings. First off all, the reason behind the dominance of shorter holding periods over longer holding periods could be that REIT performance tends to reverse in the longer time period, i.e. the winners will not perform as well in longer holding periods than shorter holding periods and vise versa with regards to losers. There is evidence in the general stock market momentum literature that stocks tend to

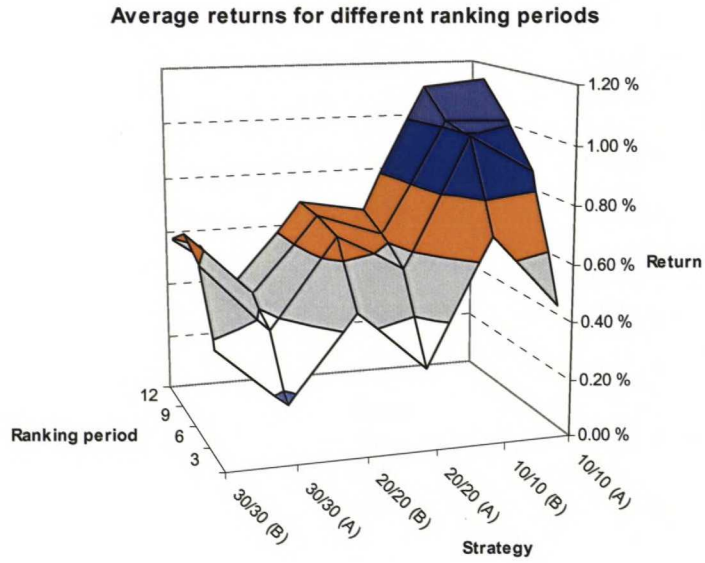
reverse in the longer holding periods[13], however in the general stock market this "longer holding period" usually refers to over 12-24 months. Thus, it could be that REITs' behavior regards to momentum phenomenon is more fluctuating compared to the general stock market and the momentum phenomenon doesn't last as long as with general stock market. Secondly, the dominance of the 10/10 strategy is in line with intuition as it uses the most extreme observations it is likely that it gives the best returns in the momentum strategy. However, as the previous analysis confirmed the 10/10 strategy's returns have the most volatility because of the extreme observations. Reason for the dominance of the "(B)" strategies over the "(A)" strategies could be that as REITs aren't very liquid stocks the thin trading might cause bias to the prices, thus the "(B)" strategies which take the bid-ask bounce to account provides better returns.

*Ranking period*

The figure 9 presents the average monthly momentum returns for different ranking periods. It is calculated by taking the average returns for 3, 6, 9 and 12 month ranking periods. The procedure is repeated for each strategy with and without the bid-ask bounce, i.e. then there are 6 different strategies in total. Strategies which have "(A)" don't take the bid-ask bounce into account and strategies which have "(B)" accommodate it by placing a one month lag between ranking and holding periods. The idea is show, e.g. what ranking periods provide the best returns.

[13] See e.g. Moskowitz and Grinblatt (1999)

**Figure 9: Average monthly momentum returns for different ranking periods**
The returns presented in the figure are averages from the different holding periods by keeping the ranking period constant, i.e. the return for ranking period 3 is the average of 4 individual returns (3 month ranking and 3, 6, 9 and 12 month holding period returns) which each have 3 month ranking periods. The same procedure is done for the 3 different cut-off points, i.e. 10/10, 20/20 and 30/30. The returns which have the lag between ranking and holding periods, i.e. take the bid-ask bounce into account are market by "(B)" and the returns without the lag are marked by "(A)".



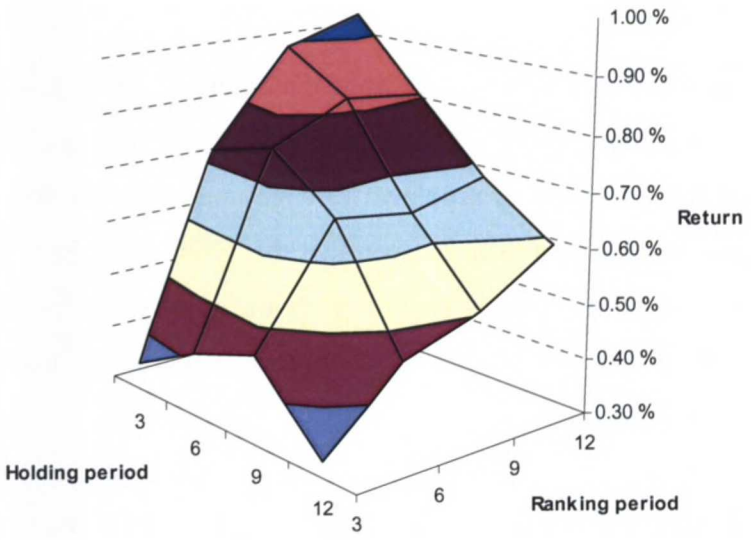

Many interesting observations can be found from the figure 9. First of all, longer ranking periods have better returns than shorter ranking periods. This can be seen by looking at the return "lines" of the each strategy: they are downward sloping relative to the decreasing of the ranking period. Also from this figure can be seen that the 10/10 is the best, 20/20 the 2nd best and 30/30 the 3rd best strategy, this is in line with the previously mentioned results. In addition, the strategies which take bid-ask bounce into account again provide better returns than strategies which don't.

The reason for the dominance of the longer ranking periods could be that REITs experience shorter term fluctuation and in order for the REITs which experience short term return continuation, i.e. momentum, to be selected to the momentum portfolio one needs to use longer ranking periods. As discussed earlier the dominance of 10/10 strategy over 20/20 and 30/30 is in line with intuition and this figure gives more support to it. Also again the "(B)" strategies give better returns than "(A)" strategies, even though there are few exceptions, e.g. 10/10 12 month ranking period. This could be due to the biases caused by thin trading to the REIT market.

Previously mentioned dominance of shorter holding periods and longer ranking periods can be clearly seen from figure 10. The figure presents averages from all individual momentum strategies according to their ranking and holding periods respectively. In order to calculate these returns strategies in which the bid-ask bounce has been taken into account are mixed together with the strategies which do not take it into account. The figure presents more evidence that long ranking period and short holding period combinations provide the best returns from the REIT momentum strategy, i.e. one can clearly see from the figure that returns rise when one moves from longer holding periods to shorter holding periods and vice versa in regards to ranking periods.

**Figure 10: Average monthly momentum returns for different ranking and holding periods**

The returns presented in the figure are averages from the different holding and ranking periods from momentum strategies. For this figure average returns from each cut-off point, i.e. 10%, 20% and 30% with and without the bid-ask bounce, are calculated. For example the 3 month holding and 3 ranking period return presented in the figure is an average from 6 individual momentum strategies, i.e. 3 strategies with 3 month ranking and holding periods in which the bid-ask bounce has been taken into account and 3 strategies in which is has not been taken into account.




### 5.1.3 Risk adjusted returns

This subchapter presents the results of Fama and French (1993) three factor model regressions, i.e. the risk adjusted returns of each momentum strategy. The three factor model is traditional asset pricing model which is based on the entire U.S. stock market. However, as REITs represent a unique group of stocks which traditionally have low correlation between

the other stocks in the market[14], the three factor model cannot explain the momentum returns very well. Also, momentum strategy provides returns which usually the model has not been able to explain[15]. Because of these two facts the three factor model cannot really explain REIT momentum profits. That's why in this subchapter only the regression alphas are reported as they clearly point out to the reader that first of all, the model cannot explain the phenomenon, and that the risk adjusted returns are close to the raw returns reported in earlier subchapter.

Table 9 presents the risk adjusted returns for the Fama and French three factor model regressions for different momentum strategies. As can be seen from the table all the returns are positive and almost all of them are highly significant when looking at the individual t-statistics. This clearly indicates that the three factor model is unable to explain the REIT momentum returns. This finding is in line with the previous literature as in past the three factor model has been unable to explain momentum returns. The same pattern of dominance of the strategies which take bid-ask bounce into account and that the 10/10 is the best, 20/20 the second best and 30/30 the third best strategy can be seen also from this table. This is in line with previously demonstrated findings.

[14] See e.g. NAREIT chart book 2007
[15] See e.g. Fama French (1996)

**Table 9: Momentum strategies' risk adjusted returns**

The momentum returns presented in the table are the excess returns calculated by the Fama and French (1993) three factor model. According to the Fama and French three factor model the excess return over the risk free rate is explained by the sensitivity of its return to three factors: 1) the excess return on a market portfolio ($R_m - R_f$), 2) the difference between the return on a portfolio of small stocks and the return of on a portfolio of large stocks (SMB, small minus big), 3) the difference between the return on a portfolio of high-book-to-market stocks and the return on a portfolio of low-book-to-market stocks (HML, high minus low). The momentum excess returns are explained by the Fama and French three factor model. This table presents the risk adjusted returns, i.e. the regression alphas for the 10/10, 20/20 and 30/30 strategies. Panel A presents the returns for strategies in which bid-ask bounce has not been taken into account. Panel B presents the returns for strategies in which the bid-ask bounce has been taken into account. T-statistics are reported in their respective lines. *, ** and *** mark the statistical significance at the 10%, 5% and 1% level respectively.

| | | | Panel A | | | | Panel B | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Ranking period | | Holding Period (K) | | | | Holding Period (K) | | | |
| | (J) | Porfolio | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 |
| 10/10 Strategy | 3 | Alpha | 0.36% * | 0.36% *** | 0.57% *** | 0.43% *** | 0.82% *** | 0.80% *** | 0.68% *** | 0.44% *** |
| | | (T-Stat) | 1.88 | 3.07 | 5.91 | 9.51 | 4.41 | 5.70 | 8.48 | 8.52 |
| | 6 | Alpha | 0.82% *** | 0.90% *** | 0.91% *** | 0.62% *** | 1.14% *** | 1.16% *** | 0.91% *** | 0.59% *** |
| | | (T-Stat) | 4.08 | 6.61 | 8.05 | 8.97 | 5.63 | 6.97 | 8.30 | 7.92 |
| | 9 | Alpha | 1.17% *** | 1.06% *** | 0.89% *** | 0.69% *** | 1.42% *** | 1.13% *** | 0.86% *** | 0.61% *** |
| | | (T-Stat) | 4.76 | 7.66 | 8.61 | 8.48 | 6.20 | 7.76 | 7.71 | 7.05 |
| | 12 | Alpha | 1.46% *** | 1.16% *** | 1.06% *** | 0.90% *** | 1.47% *** | 1.23% *** | 1.01% *** | 0.83% *** |
| | | (T-Stat) | 5.80 | 9.47 | 9.94 | 9.68 | 6.55 | 8.55 | 9.01 | 8.79 |
| 20/20 Strategy | 3 | Alpha | 0.18% | 0.16% ** | 0.33% *** | 0.27% *** | 0.57% *** | 0.51% *** | 0.44% *** | 0.28% *** |
| | | (T-Stat) | 1.28 | 2.09 | 5.62 | 8.37 | 4.89 | 6.36 | 8.96 | 7.42 |
| | 6 | Alpha | 0.50% *** | 0.58% *** | 0.60% *** | 0.40% *** | 0.85% *** | 0.79% *** | 0.60% *** | 0.38% *** |
| | | (T-Stat) | 3.81 | 7.00 | 9.15 | 8.43 | 6.22 | 7.64 | 9.76 | 7.08 |
| | 9 | Alpha | 0.67% *** | 0.72% *** | 0.59% *** | 0.45% *** | 0.98% *** | 0.81% *** | 0.57% *** | 0.44% *** |
| | | (T-Stat) | 4.47 | 7.89 | 7.94 | 7.39 | 7.25 | 7.97 | 7.53 | 6.69 |
| | 12 | Alpha | 0.82% *** | 0.72% *** | 0.63% *** | 0.53% *** | 0.98% *** | 0.79% *** | 0.63% *** | 0.50% *** |
| | | (T-Stat) | 5.66 | 8.32 | 8.44 | 8.08 | 6.75 | 7.40 | 7.74 | 7.26 |
| 30/30 Strategy | 3 | Alpha | 0.07% | 0.10% * | 0.25% *** | 0.20% *** | 0.41% *** | 0.39% *** | 0.35% *** | 0.20% *** |
| | | (T-Stat) | 0.59 | 1.70 | 5.29 | 7.27 | 4.34 | 6.45 | 8.98 | 7.08 |
| | 6 | Alpha | 0.33% *** | 0.37% *** | 0.41% *** | 0.26% *** | 0.62% *** | 0.56% *** | 0.42% *** | 0.27% *** |
| | | (T-Stat) | 3.26 | 5.95 | 7.97 | 6.45 | 5.95 | 7.13 | 8.48 | 5.77 |
| | 9 | Alpha | 0.46% *** | 0.50% *** | 0.43% *** | 0.32% *** | 0.70% *** | 0.60% *** | 0.43% *** | 0.31% *** |
| | | (T-Stat) | 4.17 | 7.90 | 7.44 | 6.52 | 6.93 | 7.88 | 7.08 | 5.86 |
| | 12 | Alpha | 0.55% *** | 0.49% *** | 0.40% *** | 0.33% *** | 0.66% *** | 0.52% *** | 0.38% *** | 0.32% *** |
| | | (T-Stat) | 4.73 | 6.30 | 6.53 | 6.00 | 5.61 | 5.64 | 5.71 | 5.56 |

The evidence presented here by the table 9 clearly fails to reject the hypothesis 3, i.e. that the momentum returns aren't caused by the traditional risk factors. As the Fama and French alphas are all positive and on average clearly statistically significant it can be stated that the three factor model cannot explain the abnormal REIT momentum profits.

### *5.1.4 Returns for two subperiods*

This subchapter presents the results regarding the momentum returns in the two subperiods, 1.1.1995 – 31.12.2001 and 1.1.2002 – 31.12.2007. All of the three cut-off points, i.e. 10%, 20% and 30% are studied separately. According to the Hong et al. (1999) information diffusion theory the momentum returns should be bigger in the former subperiod as then the REITs were not as popular as in the latter subperiod. This led to slower information diffusion in the former subperiod which should cause stronger momentum phenomenon.

*10/10 Strategy*

Table 10 presents the results for the 10/10 momentum strategy returns for the two subperiods. The first subperiod is 1.1.1995 – 31.12.2001 and the second 1.1.2002 – 31.12.2007. Also their differences are reported.

**Table 10: Momentum returns for 10/10 strategy in two subperiods**

The momentum portfolios are formed based on the return of REITs in the last J-months and are held for K-months. The values of J and K for different strategies are indicated in the first column and first row. The REITs are ranked based on their J-month return and top 10 % of REITs are bought and bottom 10 % sold short to form the zero cost momentum portfolios. The average monthly returns of these portfolios and their difference for each subperiod are presented in the table. The first subperiod is 1.1.1995 – 31.12.2001 and the second 1.1.2002 – 31.12.2007. The momentum portfolios in Panel A are formed right after the ranking period returns are calculated. The momentum portfolios in Panel B are formed one month after the lagged returns are measured, thus to avoid the possible effects of the bid-ask bounce. T-statistics are in Italics. *, ** and *** mark the statistical significance at the 10%, 5% and 1 % level respectively.

| | | Panel A | | | | Panel B | | | |
|---|---|---|---|---|---|---|---|---|---|
| Ranking period | | Holding period (K) | | | | Holding period (K) | | | |
| (J) | Investment period | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 |
| 3 | 1.1.1995 - 31.12.2001 | 0.13 % | 0.45 % | 0.54 % | 0.53 % | 0.67 % | 0.64 % | 0.76 % | 0.58 % |
| | 1.1.2002 - 31.12.2007 | 0.50 % | 0.33 % | 0.64 % | 0.34 % | 0.86 % | 1.08 % | 0.63 % | 0.31 % |
| | **Earlier - later** | **-0.37 %** | **0.12 %** | **-0.10 %** | **0.19 %** ** | **-0.19 %** | **-0.43 %** | **0.14 %** | **0.27 %** *** |
| | (T-stat) | *-1.01* | *0.52* | *-0.54* | *2.19* | *-0.53* | *-1.62* | *0.88* | *2.82* |
| 6 | 1.1.1995 - 31.12.2001 | 1.00 % | 1.04 % | 1.03 % | 0.82 % | 1.27 % | 1.25 % | 1.06 % | 0.79 % |
| | 1.1.2002 - 31.12.2007 | 0.74 % | 0.82 % | 0.86 % | 0.47 % | 1.04 % | 1.18 % | 0.82 % | 0.46 % |
| | **Earlier - later** | **0.26 %** | **0.22 %** | **0.17 %** | **0.35 %** ** | **0.24 %** | **0.07 %** | **0.24 %** | **0.34 %** ** |
| | (T-stat) | *0.56* | *0.69* | *0.72* | *2.56* | *0.62* | *0.21* | *1.16* | *2.33* |
| 9 | 1.1.1995 - 31.12.2001 | 1.35 % | 1.31 % | 1.12 % | 0.93 % | 1.49 % | 1.31 % | 1.02 % | 0.87 % |
| | 1.1.2002 - 31.12.2007 | 1.09 % | 0.97 % | 0.73 % | 0.51 % | 1.29 % | 0.95 % | 0.71 % | 0.38 % |
| | **Earlier - later** | **0.26 %** | **0.35 %** | **0.39 %** * | **0.43 %** *** | **0.19 %** | **0.36 %** | **0.31 %** | **0.48 %** |
| | (T-stat) | *0.55* | *1.22* | *1.97* | *2.83* | *0.44* | *1.33* | *1.47* | *1.47* |
| 12 | 1.1.1995 - 31.12.2001 | 1.54 % | 1.43 % | 1.23 % | 1.05 % | 1.51 % | 1.36 % | 1.17 % | 0.96 % |
| | 1.1.2002 - 31.12.2007 | 1.30 % | 0.85 % | 0.87 % | 0.78 % | 1.24 % | 1.07 % | 0.82 % | 0.75 % |
| | **Earlier - later** | **0.23 %** | **0.58 %** ** | **0.36 %** * | **0.27 %** | **0.27 %** | **0.29 %** | **0.34 %** | **0.20 %** |
| | (T-stat) | *0.48* | *2.55* | *1.78* | *1.53* | *0.62* | *1.08* | *1.64* | *1.13* |

T-statistics reported in the tables 10, 11 and 12 refer to the hypothesis:

$H_0$: $\mu_0 = \mu_1$

$H_1$: $\mu_0 > \mu_1$

Where $\mu_0$ is average monthly return in the first subperiod and $\mu_1$ is the average monthly return in second subperiod.

The results in the table 10 indicate that in most cases the momentum return in the earlier period is bigger than in later period. The differences between panels A and B are rather small, i.e. one cannot say that in either case the first period return has been stronger than in the other. However, the t-statistics are fairly low on average so in only a few cases the first period

returns are statistically significantly stronger than in the second period. This is due to the fact that in absolute terms the difference is pretty small, i.e. only some basis points and also the number of observations is a lot smaller compared to the initial analysis as now the sample period is divided into two, thus the phenomenon is not strong enough to become statistically significant. However, when looking at the absolute return figures there is evidence which support the hypothesis number two which is based on the Hong et. al (1999) information diffusion theory.

*20/20 strategy*

Table 11 presents the results for the subperiod momentum returns for 20/20 strategy. Again most of the first period returns are stronger than the second period returns, thus supporting the Hong et al. (1999) information diffusion theory. However, the t-statistics are quite moderate, thus the differences are not statistically significant in most of the cases. The differences between panels A and B are small, i.e. the bid-ask bounce has only a modest effect on these returns.

**Table 11: Momentum returns for 20/20 strategy for two subperiods**

The momentum portfolios are formed based on the return of REITs in the last J-months and are held for K-months. The values of J and K for different strategies are indicated in the first column and first row. The REITs are ranked based on their J-month return and top 20 % of REITs are bought and bottom 20 % sold to form the zero cost momentum portfolio. The average monthly returns of these portfolios and their difference for each subperiod are presented in the table. The first subperiod is 1.1.1995 – 31.12.2001 and the second 1.1.2002 – 31.12.2007. The momentum portfolios in Panel A are formed right after the ranking period returns are calculated. The momentum portfolios in Panel B are formed one month after the lagged returns are measured, thus to avoid the possible effects of the bid-ask bounce. T-statistics are in Italics. *, ** and *** mark the statistical significance at the 10%, 5% and 1 % level respectively.

| | | Panel A | | | | | Panel B | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Ranking period | | Holding period (K) | | | | | Holding period (K) | | | | |
| (J) | Investment period | 3 | 6 | 9 | 12 | | 3 | 6 | 9 | 12 | |
| 3 | 1.1.1995 - 31.12.2001 | -0.01 % | 0.22 % | 0.33 % | 0.33 % | | 0.48 % | 0.43 % | 0.51 % | 0.37 % | |
| | 1.1.2002 - 31.12.2007 | 0.31 % | 0.15 % | 0.40 % | 0.26 % | | 0.59 % | 0.68 % | 0.41 % | 0.21 % | |
| | **Earlier - later** | **-0.31 %** | **0.07 %** | **-0.07 %** | **0.06 %** | | **-0.11 %** | **-0.26 %** | **0.11 %** | **0.16 %** | ** |
| | (T-stat) | *-1.20* | *0.46* | *-0.61* | *0.97* | | *-0.49* | *-1.61* | *1.11* | *2.21* | |
| 6 | 1.1.1995 - 31.12.2001 | 0.51 % | 0.67 % | 0.71 % | 0.54 % | | 0.86 % | 0.86 % | 0.75 % | 0.54 % | |
| | 1.1.2002 - 31.12.2007 | 0.54 % | 0.51 % | 0.51 % | 0.29 % | | 0.81 % | 0.75 % | 0.45 % | 0.25 % | |
| | **Earlier - later** | **-0.03 %** | **0.15 %** | **0.20 %** | **0.26 %** | *** | **0.05 %** | **0.12 %** | **0.30 %** | *** | **0.29 %** *** |
| | (T-stat) | *-0.14* | *0.97* | *1.60* | *2.86* | | *0.19* | *0.60* | *2.64* | | *2.85* |
| 9 | 1.1.1995 - 31.12.2001 | 0.69 % | 0.81 % | 0.70 % | 0.57 % | | 1.06 % | 0.88 % | 0.70 % | 0.56 % | |
| | 1.1.2002 - 31.12.2007 | 0.66 % | 0.64 % | 0.48 % | 0.37 % | | 0.82 % | 0.72 % | 0.42 % | 0.36 % | |
| | **Earlier - later** | **0.02 %** | **0.18 %** | **0.22 %** | **0.20 %** | * | **0.24 %** | **0.16 %** | **0.28 %** | * | **0.19 %** |
| | (T-stat) | *0.09* | *1.02* | *1.60* | *1.74* | | *0.92* | *0.86* | *1.97* | | *1.53* |
| 12 | 1.1.1995 - 31.12.2001 | 0.80 % | 0.79 % | 0.67 % | 0.58 % | | 0.99 % | 0.77 % | 0.65 % | 0.56 % | |
| | 1.1.2002 - 31.12.2007 | 0.77 % | 0.62 % | 0.58 % | 0.52 % | | 0.83 % | 0.78 % | 0.58 % | 0.47 % | |
| | **Earlier - later** | **0.03 %** | **0.17 %** | **0.08 %** | **0.07 %** | | **0.16 %** | **-0.01 %** | **0.08 %** | **0.09 %** | |
| | (T-stat) | *-0.65* | *-0.33* | *0.59* | *0.52* | | *0.56* | *-0.06* | *0.51* | *0.66* | |

*30/30 strategy*

Table 12 presents the results for the subperiod momentum returns for 30/30 strategy. Again most of the first period returns are stronger than the second period returns, thus supporting the Hong et al. (1999) information diffusion theory. However, the t-statistics are quite moderate, thus the differences are not statistically significant in most of the cases. In Panel A the first period returns are the strongest comparing to the other strategies, i.e. from the 16 strategies in total, in 8 cases the second subperiod return is stronger. This gives evidence that the Hong et al. (1999) information diffusion theory is not very strong in this case. This could be due to the fact that the theory has biggest effect in the most extreme momentum REITs, i.e. cut-off point of 10% and 20%.

**Table 12: Momentum returns for 30/30 strategy for two subperiods**

The momentum portfolios are formed based on the return of REITs in the last J-months and are held for K-months. The values of J and K for different strategies are indicated in the first column and first row. The REITs are ranked based on their J-month return and top 30 % of REITs are bought and bottom 30 % sold to form the zero cost momentum portfolio. The average monthly returns of these portfolios and their difference for each subperiod are presented in the table. The first subperiod is 1.1.1995 – 31.12.2001 and the second 1.1.2002 – 31.12.2007. The momentum portfolios in Panel A are formed right after the ranking period returns are calculated. The momentum portfolios in Panel B are formed one month after the lagged returns are measured, thus to avoid the possible effects of the bid-ask bounce. T-statistics are in Italics. *, ** and *** mark the statistical significance at the 10%, 5% and 1 % level respectively.

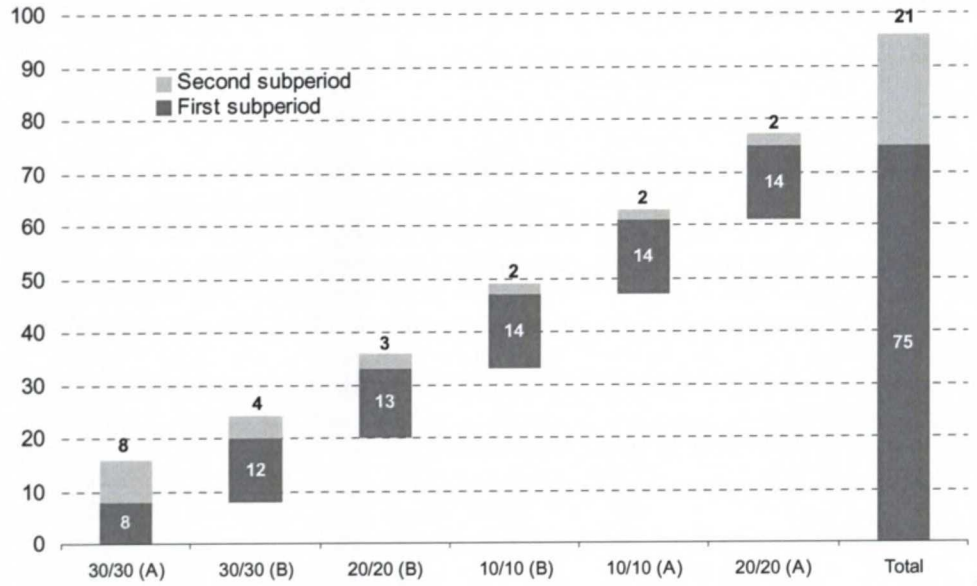
| | | Panel A | | | | Panel B | | | |
|---|---|---|---|---|---|---|---|---|---|
| Ranking period | | Holding period (K) | | | | Holding period (K) | | | |
| (J) | Investment period | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 |
| 3 | 1.1.1995 - 31.12.2001 | -0.10 % | 0.16 % | 0.23 % | 0.23 % | 0.34 % | 0.34 % | 0.39 % | 0.26 % |
| | 1.1.2002 - 31.12.2007 | 0.17 % | 0.08 % | 0.33 % | 0.23 % | 0.41 % | 0.50 % | 0.35 % | 0.17 % |
| | **Earlier - later** | **-0.27 %** | **0.08 %** | **-0.09 %** | **0.003 %** | **-0.07 %** | **-0.17 %** | **0.05 %** | **0.09 %** |
| | (T-stat) | *-1.24* | *0.64* | *-1.02* | *0.06* | *-0.41* | *-1.43* | *0.60* | *1.59* |
| 6 | 1.1.1995 - 31.12.2001 | 0.28 % | 0.42 % | 0.48 % | 0.36 % | 0.62 % | 0.61 % | 0.53 % | 0.37 % |
| | 1.1.2002 - 31.12.2007 | 0.40 % | 0.35 % | 0.35 % | 0.19 % | 0.58 % | 0.54 % | 0.29 % | 0.18 % |
| | **Earlier - later** | **-0.13 %** | **0.08 %** | **0.13 %** | **0.17 %** ** | **0.04 %** | **0.08 %** | **0.24 %** *** | **0.19 %** ** |
| | (T-stat) | *-0.66* | *0.64* | *1.32* | *2.16* | *0.18* | *0.50* | *2.62* | *2.17* |
| 9 | 1.1.1995 - 31.12.2001 | 0.41 % | 0.55 % | 0.48 % | 0.38 % | 0.76 % | 0.64 % | 0.50 % | 0.38 % |
| | 1.1.2002 - 31.12.2007 | 0.48 % | 0.43 % | 0.38 % | 0.30 % | 0.55 % | 0.55 % | 0.35 % | 0.27 % |
| | **Earlier - later** | **-0.07 %** | **0.12 %** | **0.10 %** | **0.08 %** | **0.21 %** | **0.09 %** | **0.15 %** | **0.11 %** |
| | (T-stat) | *-0.35* | *1.02* | *0.88* | *0.82* | *1.09* | *0.63* | *1.30* | *1.03* |
| 12 | 1.1.1995 - 31.12.2001 | 0.45 % | 0.45 % | 0.39 % | 0.30 % | 0.53 % | 0.43 % | 0.36 % | 0.28 % |
| | 1.1.2002 - 31.12.2007 | 0.59 % | 0.49 % | 0.40 % | 0.38 % | 0.66 % | 0.60 % | 0.38 % | 0.40 % |
| | **Earlier - later** | **-0.15 %** | **-0.05 %** | **-0.02 %** | **-0.08 %** | **-0.14 %** | **-0.17 %** | **-0.02 %** | **-0.12 %** |
| | (T-stat) | *-0.65* | *-0.33* | *-0.16* | *-0.74* | *-0.61* | *-0.97* | *-0.12* | *-1.07* |

As again there are 96 strategies in total, summary is presented by using figure 11 in order to highlight the evidence to the reader regarding the hypothesis 2, i.e. that in the first subperiod the momentum returns are bigger than in the second. Figure 11 highlights the absolute differences of the momentum returns in between the two subperiods under each strategy, i.e. 10/10 A, 10/10 B, 20/20 A, 20/20 B, 30/30 A and 30/30 B. All of the individual cut-off points

contain total number of 16 individual momentum strategies, i.e. they sum up to 16 and in total there 96 strategies.

**Figure 11: Summary of first and second subperiods' momentum returns**

The figure presents which subperiod's momentum return is bigger under each strategy. Note that each strategy has 16 observations, thus in total there are 96 observations. "(A)" represents strategy in which the effects of the bid-ask bounce have not been taken into account. "(B)" represents strategy in which the effects of the bid-ask bounce have been taken into account by adding one month lag in between holding and ranking periods. The bottom part of the pillars represents the number of strategies in which the first subperiod return is bigger. The upper part of the pillars present the number of strategies in which the second subperiod momentum return is bigger than the first subperiod. First subperiod is 1.1.1995 – 31.12.2001. The 2nd subperiod is 1.1.2002 – 31.12.2007.




It can be seen from the figure 11 that on average the first subperiod momentum returns clearly dominate the second subperiod, from the 96 momentum strategies studied in 75 the first subperiod's returns are bigger. This evidence supports the Hong et al. (1999) information diffusion theory as potential explanation of momentum returns. As have been previously presented in the first subperiod REITs were not as "popular" as in the second subperiod, thus according to the information diffusion theory this should lead to stronger momentum returns in the first subperiod.

The evidence presented here can be considered at least semi strong. Even though the first subperiod returns are statistically bigger in only few cases, the fact that in absolute terms in 72% of the cases the first subperiod's momentum return is stronger. As have been previously

discussed, the phenomenon is not strong enough to become statistically significant due to the limited number of observations compared to the full sample momentum returns.

### 5.1.5 Momentum REIT characteristics

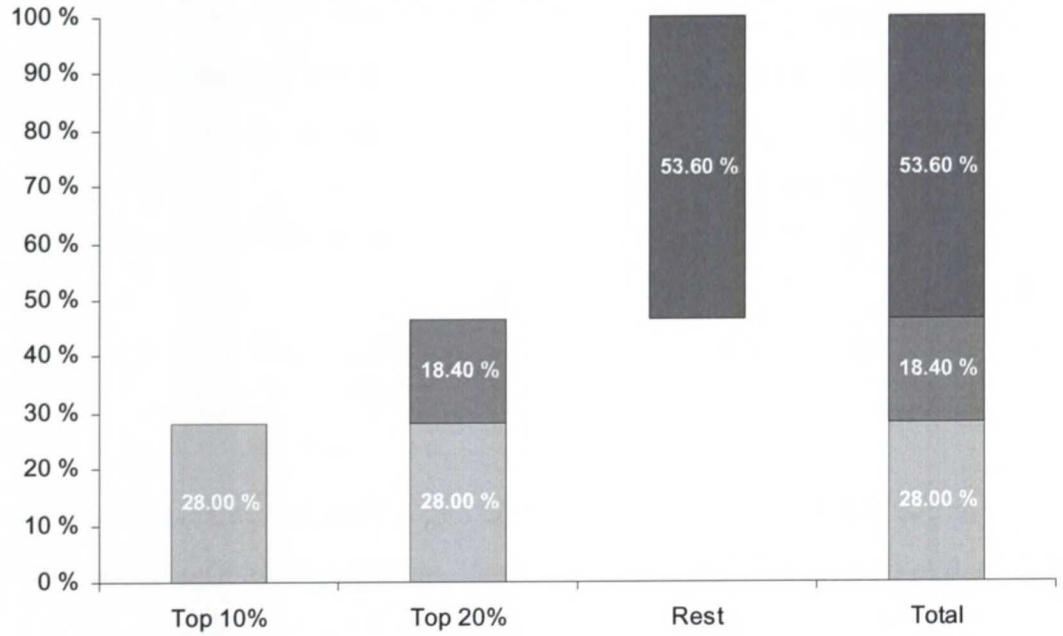
The momentum strategy forms zero cost portfolios based on the returns of the REITs in the ranking period. The only requirement for a single REIT to be selected in the portfolio is that its return in the ranking period has to be bigger or lower than the selected cut-off point compared to the sample average, e.g. 10% in the 10/10 strategy. As there are no specific "requirements" two interesting questions arises:

1) Is there subgroup of REITs which are selected to the portfolios more often than other REITs?
2) If so, do the REITs which are selected to the momentum portfolio have some common characteristics, e.g. more risk etc.?

In order to find the answer to these two questions, four individual momentum strategies are studied in detail as they present evidence also from all other strategies. The selected strategies are 10/10 (B) R6H3, 10/10 (B) R6H6, 10/10 (B) R6H9 and 10/10 (B) R6H12. The composition of these portfolios is examined in order to find out whether some subgroup of REITs is selected to the momentum portfolios more often than REITs on average.

Figure 12 shows the average composition the four selected strategies; i.e. how equal is the distribution of REITs in the momentum portfolios. From the figure 12 one can easily see that the most often selected 20% of REITs are responsible for 46.4% of the total observations on average, i.e. that these 20% of REITs appear in the momentum portfolio very often, compared to the REITs on average. This is a clear answer to the previously presented question 1, thus it can be stated that the there is subgroup of REITs which appear in the momentum portfolio more often than the average REIT in the sample. Next step is to find out whether these REITs have some kind of common characteristics.

**Figure 12: Four selected REIT momentum strategies' portfolios average content**
In the figure is presented how big part from total observations do top 10% and 20% REITs generate on average in four selected momentum strategies. For example, top 10 % REITs create 28% of all observations and top 20% create 46.4% of all observations. Observation in this case means an event when single REIT is selected to the momentum portfolio. This means that top 20% of REITs do get selected to momentum portfolio 46.4% of times, i.e. the top 20% of REITs appear really often in the momentum portfolio. The selected strategies are 10/10 (B) R6H3, 10/10 (B) R6H6, 10/10 (B) R6H9 and 10/10 (B) R6H12. The strategies are otherwise the same, i.e. 10% cut-off point and 6 month ranking period except the holding period which varies from 3 to 12 months.




Now the attention is turned into the common characteristics that these top 20% REITs have. Top 20% is selected as the "momentum REIT" group as there are approximately 30 REITs in that sample. They are then compared to the full sample in order to find out whether these 30 REITs have common characteristics.

Table 13 presents the results of the common characteristics analysis of momentum REITs. Most of them are following intuition, i.e. support the hypothesis that momentum REITs are more risky than REITs in general. First of all, momentum REITs have on average $431 Mil. smaller market capitalization than REITs in general, meaning that they are smaller, thus more risky than the average REIT in the sample. Second, momentum REIT companies have 26 percentage points lower average institutional ownership than the full REIT sample. This finding gives more support to the Hong et al. (1999) information diffusion theory, which hypothesize that slower information diffusion creates more momentum returns. Institutional ownership is a clear proxy for popularity of a company, i.e. the more institutional ownership the company has the more its traded and has more analyst coverage etc. Thus, it can be stated

that all else equal companies with low institutional ownership have lower information diffusion.

Next interesting finding is that the momentum REITs have a lot more fluctuating earnings per share figure than the full REIT sample. This finding again clearly supports the view that momentum REITs are in fact more risky than REITs in general. Earnings per share is good measure for company's earnings and the more it fluctuates over time the more risky company's business is. Also the two variables which display the amount of leverage: debt to equity and debt to assets show evidence that momentum REITs are more risky than REITs on average as they have more leverage than the REITs in the full sample. Debt to equity is 142% and debt to assets 35% bigger with momentum REITs compared to the full REIT sample. This finding is in line with Avramov et al. (2006) which finds that extreme momentum portfolios are predominantly composed of high credit risk stocks.

**Table 13: Common characteristics of momentum REITs**

Table presents common characteristics that the 30 momentum REITs have compared to the full REIT sample of 146. Market capitalization is the average of monthly market capitalizations. Institutional ownership is quarterly averages of institutional ownership from 13 F holdings. EPS is earnings per share; averages from quarterly observations. Debt to equity is total debt pct. common equity; medians from quarterly observations. Debt to assets is total debt pct. total assets; medians from quarterly observations. Source: Worldscope

| Variable | Method | Momentum REIT | Full sample | Conclusion |
|---|---|---|---|---|
| Market capitalization | Average | $527 Mil. | $958 Mil. | Momentum REITs have $431 Mil. smaller market capitalization, i.e. they are smaller, thus more risky firms. |
| Institutional ownership | Average | 33 % | 59 % | Momentum REITs have 26 percentage units smaller institutional ownership. This finding gives more support to the Hong et al. (1999) information diffusion theory as a possible explanation of mometum profits. |
| Earnings per share | Variance | 0.16 | 0.05 | Momentum REITs have 202 % higher median variance in earnings per share, i.e. their cash flows fluctuate a lot more than REITs in the full sample. |
| Debt to equity | Median | 3.54 | 1.46 | Momentum REITs have 142 % bigger debt to equity ratio, i.e. they are more levered and thus more risky |
| Debt to assets | Median | 0.69 | 0.51 | Momentum REITs have 35% bigger median debt to assets ratio, i.e. they are more levered and thus more risky |

| N | |
|---|---|
| Momentum REITs | 30 |
| Full REIT sample | 147 |

## 5.2 Robustness check for momentum strategies

It was previously demonstrated that the REIT momentum strategies generate abnormal profits. This chapter presents robustness checks for the momentum strategies as it tackles two very important issues regarding the momentum strategies:

1. Are momentum profits robust of trading costs?
2. How big of a momentum portfolio could one institutional investor construct, i.e. how much is the trading volume of momentum REITs?

### 5.2.1 Transaction costs

In order to examine the effect the transaction costs have for momentum profits, 6 different total execution cost estimates are used. The estimates are taken from Jones and Lipson (2001), Keim and Madhavan (1997) which explicitly study the transaction costs and come up with estimates for trading in different exchanges and what's important also for the momentum trading strategies. It is important to test the momentum profits robustness with several transaction cost estimates as it's impossible to come up with one single estimate of total execution cost. By studying several transaction costs' effects I'm able to acquire evidence about the potential break even cost level and this evidence can be used in observing the profitability of the momentum strategies.

Table 14 presents the different transaction cost estimates used in this study. Three of the estimates are taken from Jones and Lipson (2001) and three are from Keim and Madhavan (1997). The estimates are at the upper end of the estimates in those articles, as it can be argued that the REIT momentum strategies would not be cheap to execute in a real life setting due to their lower liquidity and limited number REITs available. The table also gives short description of the transaction cost estimate, e.g. from what stock exchange it has been calculated. Keim and Madhavan (1997) also divide the transaction costs to buyer and seller initiated trading.

**Table 14: Summary of transaction cost estimates**

Table presents the total execution transaction cost estimates used in this study. The estimates are taken from two papers: Jones and Lipson (2001), Keim and Madhavan (1997). Jones and Lipson (2001) use dataset provided by the provided by the Plexus Group. The company is a consulting firm that works with institutional investors to monitor and reduce their trading costs, their clients manage over $1.5 trillion in equity assets. Plexus group has also access to trading records of 25% of U.S. marketplace volume. Their dataset consists of 386 487 orders executed for Plexus clients in 1271 NYSE stocks. Keim and Madhavan (1997) use also dataset provided by the Plexus Group. Their data set consists of order level data and includes $83 billion worth of transactions.

| Transaction cost | Paper | Description |
|---|---|---|
| 0.710 % | Keim and Madhavan (1997) | Buyer initiated momentum trading in exchange listed stocks |
| 0.870 % | Keim and Madhavan (1997) | Seller initiated momentum trading in exchange listed stocks |
| 1.206 % | Jones and Lipson (2001) | Momentum trading in NYSE before the change* |
| 1.390 % | Keim and Madhavan (1997) | Buyer initiated momentum trading in NASDAQ listed stocks |
| 1.517 % | Jones and Lipson (2001) | Momentum trading in NYSE after the change* |
| 1.680 % | Keim and Madhavan (1997) | Seller initiated momentum trading in NASDAQ listed stocks |

* In June 1997 the New York Stock Exchange lowered its minimum price increment on most stocks from 1/8 of a dollar to 1/16 of a dollar

Table 15 presents the results from the implementation of the transaction cost model to the 16 individual momentum strategies in the 10/10 (B) setup, i.e. the different combinations of the ranking and holding periods when 10% is the cut-off point and the bid-ask bounce has been taken into account. As can be seen from the table the amount of transaction costs increases when moving from left to the right. Also the average monthly momentum returns and their t-statistics are reported in their respective lines for each strategy. At the bottom the average return of the strategies with the selected transaction cost is presented. As was previously demonstrated the transaction costs affect most on the profits on shorter holding periods, i.e. three months. One can see from the table that three month holding period strategies loose their profitability very fast even with conservative transaction cost estimates.

**Table 15: Monthly returns after transaction costs on the 10/10 (B) momentum strategies**
The table presents the results from implementing the different one way transactions costs to all of the individual momentum portfolios in the 10/10 (B) strategy, i.e. a strategy which has top and bottom 10% as the cut-off points and in which the effects of bid-ask bounce is taken into account. The monthly average momentum returns and t-statistics are reported in their respective lines. *, ** and *** mark the statistical significance at the 10%, 5% and 1% level respectively. In the 0% case there are no transaction costs, thus the returns are equal with previously presented. 0.710% is Keim et al. (1997) estimate for buyer initiated momentum trading. 0.870 % is Keim et al. (1997) estimate for seller initiated momentum trading. 1.206 % is Jones et al. estimate for momentum trading before NYSE lowered its minimum price increment on most of its stocks from 1/8 of a dollar to 1/16 of a dollar. 1.390 % is Keim et al. (1997) estimate for buyer initiated momentum trading in NASDAQ. 1.517 % is Jones et al. (2001) estimate for momentum trading after NYSE lowered its minimum price increment on most of its stocks from 1/8 of a dollar to 1/16 of a dollar. 1.680 % is Keim et al. (1997) estimate for seller initiated technical trading in NASDAQ.

| | Transaction cost | | | | | | |
|---|---|---|---|---|---|---|---|
| **Strategy** | **0.000 %** | **0.710 %** | **0.870 %** | **1.206 %** | **1.390 %** | **1.517 %** | **1.680 %** |
| R3 H3 | **0.756 %** | **-0.188 %** | **-0.401 %** | **-0.847 %** | **-1.092 %** | **-1.260 %** | **-1.477 %** |
| *T-Stat* | *1.320* | *-0.243* | *-0.455* | *-0.722* | *-0.793* | *-0.822* | *-0.842* |
| R3 H6 | **0.836 %** *** | **0.359 %** | **0.252 %** | **0.026 %** | **-0.097 %** | **-0.182 %** | **-0.292 %** |
| *T-Stat* | *2.661* | *0.831* | *0.508* | *0.039* | *-0.122* | *-0.204* | *-0.283* |
| R3 H9 | **0.706 %** *** | **0.398 %** ** | **0.329 %** | **0.183 %** | **0.103 %** | **0.048 %** | **-0.023 %** |
| *T-Stat* | *7.134* | *2.160* | *1.435* | *0.518* | *0.235* | *0.095* | *-0.038* |
| R3 H12 | **0.463 %** *** | **0.230 %** ** | **0.178 %** | **0.067 %** | **0.007 %** | **-0.035 %** | **-0.089 %** |
| *T-Stat* | *11.666* | *2.110* | *1.231* | *0.278* | *0.022* | *-0.097* | *-0.205* |
| R6 H3 | **1.164 %** * | **0.211 %** | **-0.004 %** | **-0.455 %** | **-0.702 %** | **-0.873 %** | **-1.091 %** |
| *T-Stat* | *1.800* | *0.249* | *-0.004* | *-0.366* | *-0.487* | *-0.546* | *-0.601* |
| R6 H6 | **1.215 %** *** | **0.738 %** | **0.631 %** | **0.405 %** | **0.282 %** | **0.197 %** | **0.087 %** |
| *T-Stat* | *2.889* | *1.354* | *1.035* | *0.514* | *0.309* | *0.195* | *0.076* |
| R6 H9 | **0.955 %** *** | **0.630 %** ** | **0.557 %** * | **0.403 %** | **0.319 %** | **0.261 %** | **0.187 %** |
| *T-Stat* | *5.327* | *2.409* | *1.820* | *0.937* | *0.618* | *0.448* | *0.276* |
| R6 H12 | **0.648 %** *** | **0.399 %** *** | **0.343 %** * | **0.225 %** | **0.161 %** | **0.116 %** | **0.059 %** |
| *T-Stat* | *7.721* | *2.629* | *1.833* | *0.790* | *0.456* | *0.287* | *0.124* |
| R9 H3 | **1.394 %** * | **0.441 %** | **0.226 %** | **-0.225 %** | **-0.472 %** | **-0.643 %** | **-0.862 %** |
| *T-Stat* | *1.709* | *0.439* | *0.205* | *-0.162* | *-0.299* | *-0.371* | *-0.442* |
| R9 H6 | **1.145 %** *** | **0.658 %** | **0.548 %** | **0.318 %** | **0.192 %** | **0.105 %** | **-0.007 %** |
| *T-Stat* | *3.714* | *1.578* | *1.147* | *0.488* | *0.249* | *0.121* | *-0.007* |
| R9 H9 | **0.883 %** *** | **0.552 %** ** | **0.477 %** | **0.320 %** | **0.234 %** | **0.175 %** | **0.098 %** |
| *T-Stat* | *4.964* | *2.187* | *1.616* | *0.768* | *0.467* | *0.308* | *0.149* |
| R9 H12 | **0.653 %** *** | **0.398 %** ** | **0.341 %** | **0.221 %** | **0.155 %** | **0.109 %** | **0.051 %** |
| *T-Stat* | *6.194* | *2.168* | *1.539* | *0.678* | *0.391* | *0.243* | *0.096* |
| R12 H3 | **1.381 %** * | **0.428 %** | **0.213 %** | **-0.238 %** | **-0.486 %** | **-0.656 %** | **-0.875 %** |
| *T-Stat* | *1.797* | *0.451* | *0.203* | *-0.180* | *-0.320* | *-0.394* | *-0.467* |
| R12 H6 | **1.221 %** *** | **0.744 %** * | **0.637 %** | **0.411 %** | **0.288 %** | **0.202 %** | **0.093 %** |
| *T-Stat* | *4.131* | *1.785* | *1.326* | *0.627* | *0.371* | *0.233* | *0.093* |
| R12 H9 | **1.006 %** *** | **0.688 %** *** | **0.617 %** ** | **0.466 %** | **0.384 %** | **0.327 %** | **0.254 %** |
| *T-Stat* | *5.850* | *2.681* | *2.051* | *1.103* | *0.758* | *0.572* | *0.383* |
| R12 H12 | **0.865 %** *** | **0.627 %** *** | **0.573 %** ** | **0.460 %** | **0.398 %** | **0.356 %** | **0.301 %** |
| *T-Stat* | *7.159* | *3.326* | *2.576* | *1.454* | *1.046* | *0.826* | *0.601* |
| **Average Return** | **0.956 %** | **0.457 %** | **0.345 %** | **0.109 %** | **-0.020 %** | **-0.110 %** | **-0.224 %** |

From the table 15 one can clearly see that at first all, of the strategies are positive and almost all of them are statistically significant, the average return being 0.96%. However, when increasing the transaction costs the strategies first quickly lose their statistical significance and then become negative. Also the average return becomes negative when the three biggest transaction cost estimates are implemented. It has to be highlighted that these three numbers are the best estimates of the true transaction costs for REIT momentum strategies. This is

because REITs aren't as liquid as traditional stocks, thus trading them is more expensive and as these three estimates refer to general stock market momentum trading costs, I argue that they represent the level of what the REIT momentum strategy's transaction cost would be at the minimum level. Thus, I can conclude that table 15 presents clear evidence that the implementation of the transaction costs to the momentum strategies dramatically reduces the previously found momentum profits, thus the strategies are not profitable when the transaction costs have been taken to account.

### 5.2.2 Trading volume

Table 16 presents the results from the momentum strategy trading volume model. Three strategies are selected for testing: 10/10 (B) R6H6, 20/20 (B) R6H6 and 30/30 R6H6 (B). The strategies are otherwise equal but they have different cut-off points. The reasoning behind the selection of the strategies is that as they have different cut-off points they use different amount of REITs in their momentum portfolios and this naturally shows in the trading volume calculations. For example strategy which has 10 % as the cut-off point only selects the top and bottom 10 % from the total REIT sample to the momentum portfolio as the 30% strategy uses top and bottom 30% of REITs, thus naturally a single investor would be able to trade a lot bigger momentum position by using the 30/30 than 10/10 strategy.

From the table 16 it can be seen that as expected the difference between the sizes of the momentum portfolios one investor could trade varies greatly between the strategies. The 10/10 (B) R6H6 strategy's positions are very small especially when assuming that a single trader could capture only 1-3% from the total value momentum REITs. In addition, 20/20 (B) R6H6 and 30/30 (B) R6H6 strategies have bigger positions but even they pretty small, unless assuming that a single trader could capture 4-5 % from the total momentum REITs. However, interesting finding is that there is a huge increase in position sizes when comparing the averages between the two subperiods: 1.1.1995 – 31.12.2001 and 1.1.2002. – 31.12.2007. This is interesting finding as it presents some evidence that the REIT momentum strategies might become feasible for private investors in the latter subperiod. However, the evidence is strong against the feasibility of momentum strategies in the first subperiod as the positions which one investor would be able to trade are so small, i.e. in a real life setting they wouldn't generate high enough profits after transactions costs and taxes have been taken into account. In addition, the evidence indicates that REIT momentum positions are too small for an institutional investor in full sample period and in both subperiods. This evidence supports the

hypothesis 5 which projects that REIT momentum positions are too small for institutional investors.

**Table 16: Estimated monthly position sizes for REIT momentum strategies**

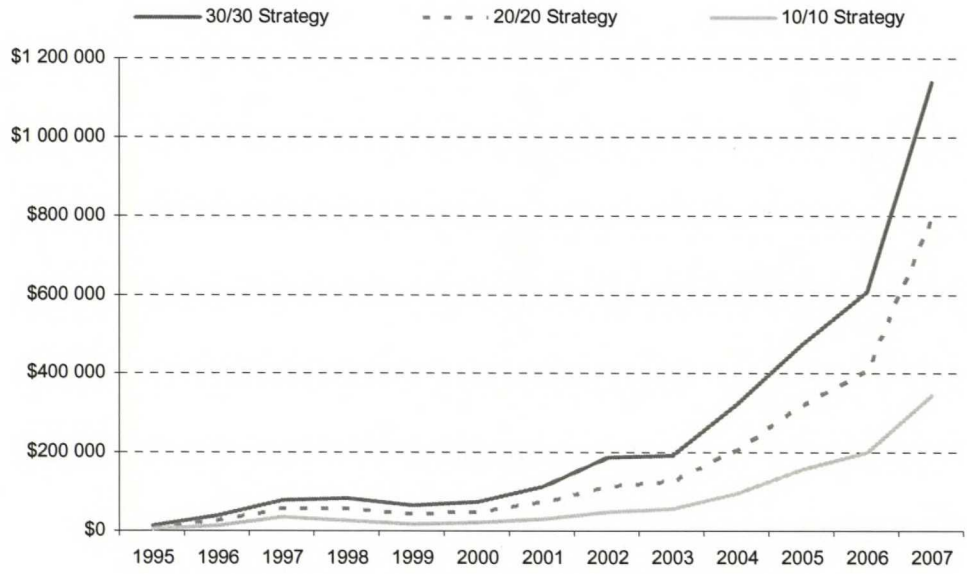
This table presents the results from the trading volume estimations. Three chosen strategies are: 10/10 (B) R6H6, i.e. 10 % cut-off point, 6 month ranking and holding periods and bid-ask bounce taken into account, 20/20 (B) R6H6, i.e. 20 % cut-off point, 6 month ranking and holding periods and bid-ask bounce taken into account and 30/30 (B) R6H6, i.e. 30 % cut-off point, 6 month ranking and holding periods and bid-ask bounce taken into account. Single trader's share from total momentum REITs is estimated to be between 1-5%. Total average is monthly average traded value for the full sample period. Average first period is the monthly average trading volume in the first subperiod 1.1.1995 - 31.12.2001. Average second period is the monthly average trading volume in the second subperiod 1.1.2002 - 31.12.2007.

| | | Single trader's share from total traded value | | | | |
|---|---|---|---|---|---|---|
| **Strategy** | **Period** | **1 %** | **2 %** | **3 %** | **4 %** | **5 %** |
| 10/10 (B) R6H6 | Total monthly average | $23 815 | $47 630 | $71 445 | $95 260 | $119 075 |
| | Monthly average 1st period | $7 682 | $15 365 | $23 047 | $30 729 | $38 412 |
| | Monthly average 2nd period | $43 174 | $86 348 | $129 523 | $172 697 | $215 871 |
| 20/20 (B) R6H6 | Total monthly average | $50 626 | $101 251 | $151 877 | $202 502 | $253 128 |
| | Monthly average 1st period | $15 855 | $31 710 | $47 565 | $63 419 | $79 274 |
| | Monthly average 2nd period | $92 351 | $184 701 | $277 052 | $369 402 | $461 753 |
| 30/30 (B) R6H6 | Total monthly average | $76 140 | $152 281 | $228 421 | $304 562 | $380 702 |
| | Monthly average 1st period | $23 934 | $47 868 | $71 801 | $95 735 | $119 669 |
| | Monthly average 2nd period | $138 789 | $277 577 | $416 366 | $555 154 | $693 943 |

Figure 13 presents the average annual momentum position sizes[16] of each strategy for the sample period of 1995 – 2007. The figure highlights very interesting issues; first of all the traded value of momentum positions has increased aggressively throughout the sample period. In the beginning position sizes are very small but in the end of the period they have increased a lot and e.g. the 30/30 strategy could have an average monthly position of over $1 Million in 2007. Nevertheless, even in that case the position sizes are so small that only a small investor could have any use for a REIT momentum strategy.

[16] Averages from the 5 positions under the assumption that a single investor would be able to trade 1-5 % of REITs in the momentum portfolio

**Figure 13: Development of monthly average momentum position sizes**
The figure presents the development of average position sizes of momentum portfolios in the three strategies, i.e. the average values under the assumption that a single trader could capture 1 – 5 % from the REITs in the momentum portfolio in one year. For example the value for 30/30 strategy in 1996 is the monthly average from total monthly position sizes between 1-5% from the total traded volume during 1996. The selected strategies are 10/10 (B) R6H6, 20/20 (B) R6H6 and 30/30 R6H6 (B). The strategies are otherwise equal but they have different cut-off points. The reasoning behind the selection of the strategies is that as they have different cut-off points they use different amount of REITs in their momentum portfolios and this naturally shows in the trading volume calculations. For example strategy which has 10 % as the cut-off point only selects the top and bottom 10 % from the total REIT sample to the momentum portfolio as the 30% strategy uses top and bottom 30% of REITs, thus naturally a single investor would be able to trade a lot bigger momentum position by using the 30/30 than 10/10 strategy.




## 5.3 *Momentum and REIT long-only strategies in portfolio diversification*

This section presents the results of what kind of benefits REIT momentum and REIT long-only strategies would give in portfolio diversification, i.e. are there any benefits of adding REIT momentum or REIT long-only strategy to a mixed-asset portfolio consisting stocks and bonds. REIT momentum strategy used throughout this chapter is 10/10 B R6H6 and REIT long-only strategy is an equally weighted strategy which invests in all the REITs in the sample.

### 5.3.1 *Correlations*

Key issue in portfolio diversification is correlation between the assets included in the portfolio. If a new asset which is not very well correlated with the old assets is added to the portfolio it can achieve better risk return characteristics than without the new asset.

Table 17 presents the results from the first correlation analysis. REIT momentum and REIT long-only strategies' correlations between some major equity and bong indices are presented. Studied time period is the entire sample period, i.e. 1995 – 2007. Table 17 provides interesting findings; first of all both REIT momentum and REIT long-only strategies have very low correlations between the indices, e.g. REIT momentum has only -0.01 correlation with the S&P 500 index which is used as a proxy for the general stock market. Interestingly, REIT long-only has also very low correlations, e.g. only 0.13 with S&P 500. REIT long-only has the smallest correlation between the Nasdaq Composite stock index of 0.05. The REIT momentum strategy has the highest correlation with the Small CAP equity index, however it is very low only 0.06.

**Table 17: Correlation coefficients of REIT momentum and REIT long-only strategies**
S&P 500 is general U.S. stock market index. MSC USA Small CAP Equity is stock index for U.S. small cap companies. NASDAQ composite is a stock index for NASDAQ stock exchange. REIT long-only is an equally weighted long-only portfolio of all the REITs in the sample. Momentum 10/10 (B) R6H6 is REIT momentum strategy which has cut-off points in top and bottom 10%, 6 month ranking and holding periods and the effects of the bid-ask bounce has been taken into account. Sample period is 1.1.1995 – 31.12.2007.

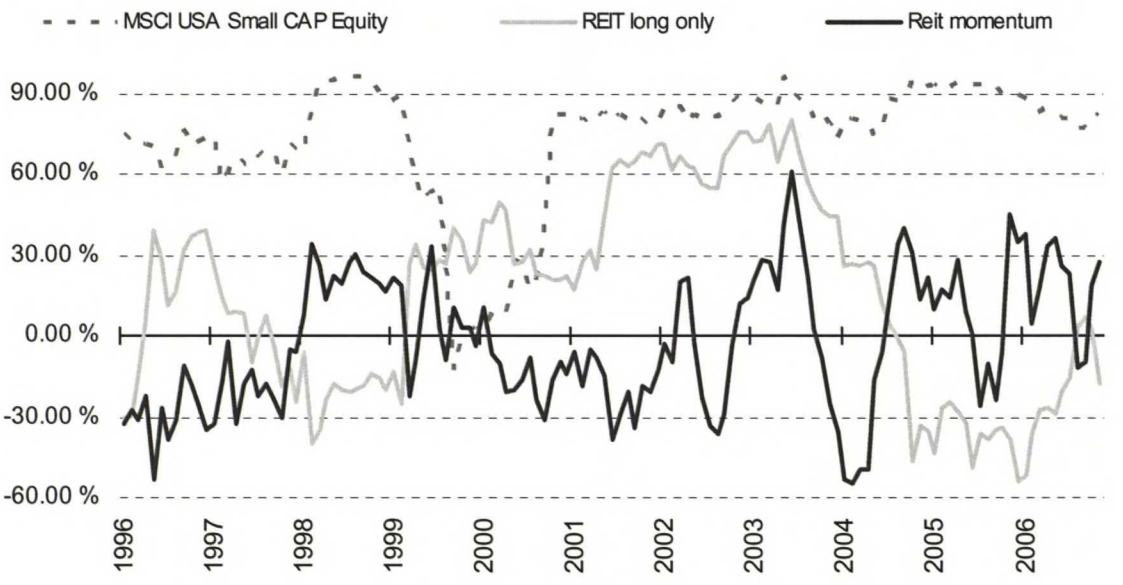
| | Correlation coefficient | | | |
|---|---|---|---|---|
| **Strategy** | **S&P 500** | **MSCI USA Small CAP Equity** | **Nasdaq Composite** | **US 30 year government bond** |
| Momentum 10/10 (B) R6 H6 | -0.01 | 0.06 | -0.04 | -0.07 |
| REIT long only | 0.13 | 0.12 | 0.05 | 0.06 |

Also an important issue regarding the correlations is how they change throughout time. If the correlations between the assets stay low for a long period of time then they can provide risk return enhancement for longer time periods.

Figure 14 presents one year rolling correlations between S&P 500 and MSCI USA Small CAP Equity, REIT long-only and REIT 10/10 B R6H6 strategy. Figure 14 presents interesting results; first of all it seems that the MSCI USA Small Cap Equity is pretty highly correlated with S&P 500 throughout the sample period. However, REIT long-only and REIT momentum strategies have much lower correlations on average with the S&P 500. REIT momentum's correlation is either 0 or under zero most of time, excluding the 2003 – 2004 time period when the correlation was higher. REIT long-only strategy has a some what bigger correlation especially in between 2001 – 2004, when it occasionally was over 60%. Figure 14 gives more evidence that REITs and especially REIT momentum strategy has diversification benefits for the investor and also that it's likely that these benefits last for long time periods.

**Figure 14: 1-year rolling correlations of REIT long-only and REIT momentum strategies**

Figure presents one year rolling correlations between S&P 500 and MSCI USA Small CAP Equity, REIT long-only and REIT 10/10 (B) R6H6 momentum strategy. S&P 500 is general U.S. stock market index. MSCI USA Small CAP equity is a U.S. stock index for small companies. REIT long-only is passive equally weighted strategy. REIT momentum refers to 10/10 B R6H6 REIT momentum strategy which has cut-off points in top and bottom 10%, 6 month ranking and holding periods and the effects of the bid-ask bounce has been taken into account. momentum strategy which has cut-off points in top and bottom 10% and where the effects of the bid-ask bounce has been taken into account.




### 5.3.2 *Performance in bear markets*

An important issue in portfolio diversification is the new assets' performance in bear markets. If the new asset can provide investor with good returns in bear markets then that asset clearly has a place in a mixed-asset portfolio, thus the main idea behind diversification is that the portfolio should have assets which produce income at different economic cycles.

Figure 15 presents the performance of REIT momentum and REIT long-only strategies in the 8 single worst months of S&P 500 stock index in between 1995 – 2007. From the figure 15 one can clearly see that on average both the REIT long-only and REIT momentum strategies have had good performance during the down months of S&P 500. REIT momentum has had positive returns 6 out of 8 and REIT long-only 4 out 8 of S&P's worst months. Interestingly the negative returns achieved by the two strategies are pretty small compared to the positive returns. This finding gives evidence that both the REIT long-only and REIT momentum strategies can be used as a hedge for the returns from S&P 500, i.e. the strategies can provide investors with positive returns when the general stock market has downturn.

**Figure 15: Performance of strategies in the 8 worst months of S&P 500 index**
The figure presents REIT long-only and REIT 10/10 B R6H6 momentum strategy's monthly performance during the 8 single worst months of the S&P 500 stock index during the period of 1.1.1995 – 31.12.2007. The 10/10 (B) R6H6 REIT momentum strategy has cut-off points in top and bottom 10%, 6 month ranking and holding periods and the effects of the bid-ask bounce has been taken into account. The S&P data is taken from Worldscope and REIT data is form Thompson and from authors' own calculations.

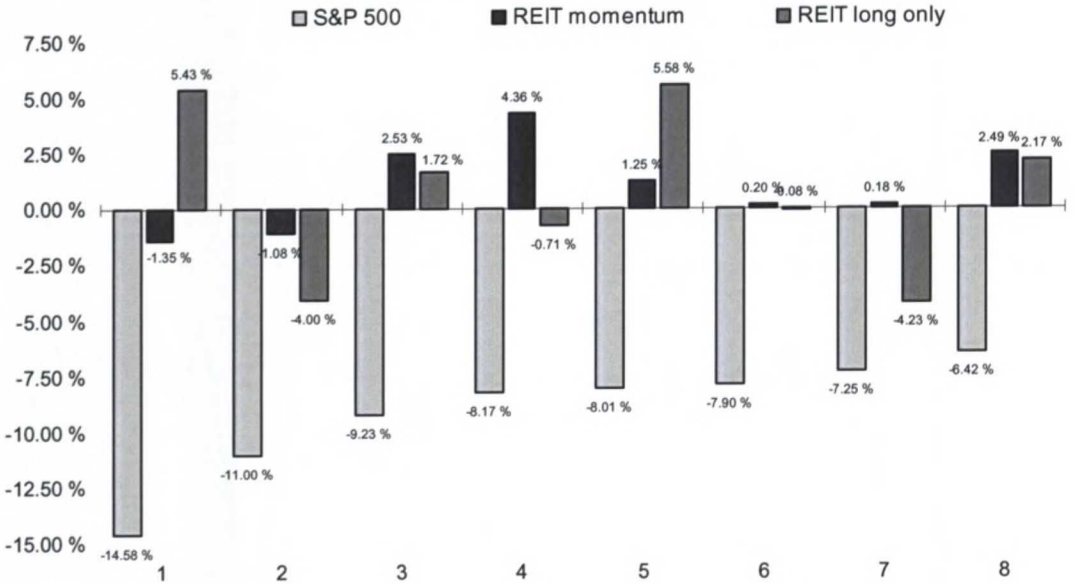



Figure 16 presents the monthly returns of S&P 500, REIT momentum and REIT long-only strategies in the recession of 2001. The dates of the recession are taken from the NBER[17] database which tracks peaks and troughs in the U.S economy. According to the NBER, there was peak in the U.S. economy in March 2001 and a trough in November 2001, i.e. the time in between them has been classified as a recession.

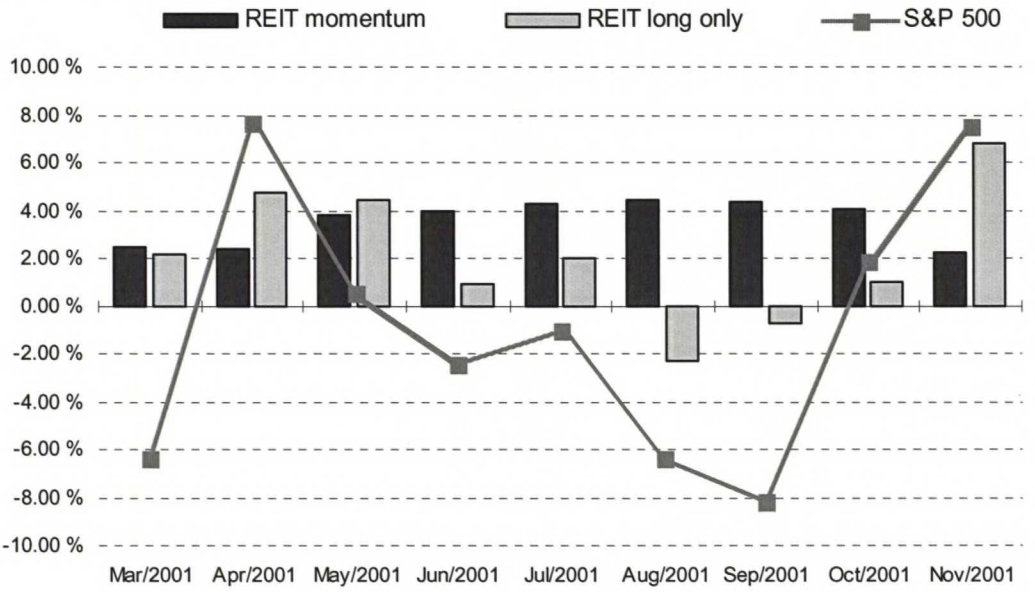
From the figure 16 one can clearly see that both the REIT long-only and REIT momentum strategies had good returns during the recession. REIT momentum didn't have any negative return month and the REIT long-only had only 2 during the 9 month period. On the other hand, S&P 500 performed badly during the recession, i.e. it had 5 negative return months and some of them were very negative, e.g. over -8% in September 2001. When looking at the cumulative returns, it is obvious that both the REIT momentum and REIT long-only outperformed the S&P during the recession. S&P had a cumulative monthly return of -8.1 %, REIT momentum had 36.82% and REIT long-only 20.33 %. The differences between the returns are staggering and give further evidence that REITs and especially REIT momentum

[17] National Bureau of Economic Research

strategies can provide investors with risk return enhancement in a mixed-asset portfolio setting.

**Figure 16: Performance of the strategies in the recession of 2001**

Figure presents the monthly returns of REIT 10/10 (B) R6H6 momentum strategy, REIT long-only and S&P 500 during the recession of 2001. The 10/10 (B) R6H6 REIT momentum strategy has cut-off points in top and bottom 10%, 6 month ranking and holding periods and the effects of the bid-ask bounce has been taken into account. The timing of the recession is taken from National Bureau of Economic Research (NBER) database. According to NBER there was a peak in U.S. economy in March 2001 and trough in November 2001, thus the time in between was a recession.

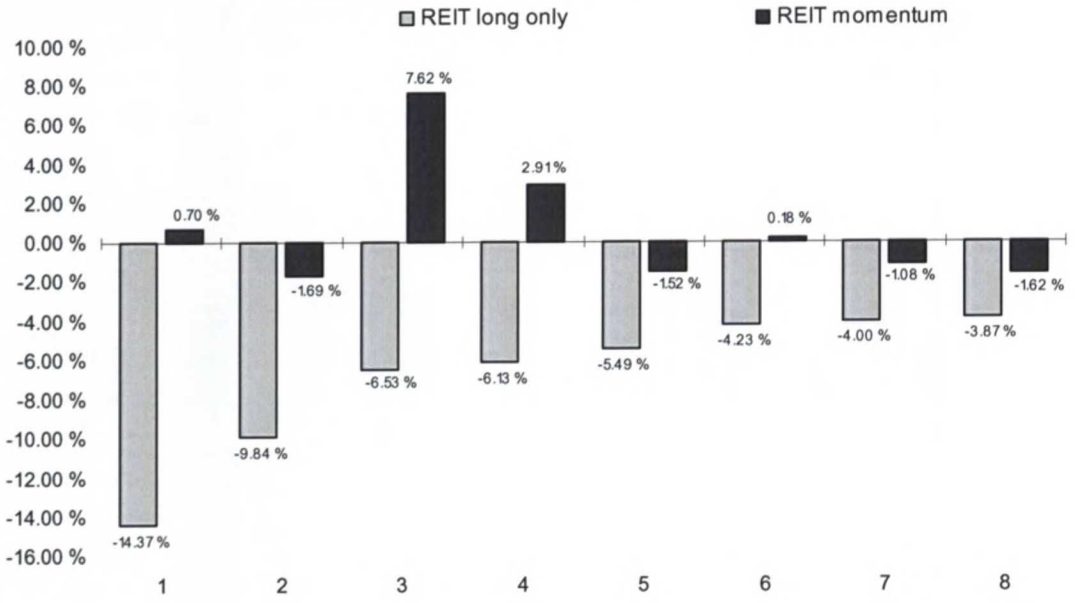



Finally it is interesting to see evidence about the performance of the REIT momentum strategy compared to the REIT long-only strategy. The momentum strategy focuses both on well performing and badly performing stocks, i.e. during the months in which the REITs perform badly there still is a possibility that the REIT momentum strategy gives good returns. The success of the momentum strategies depend more about the continuation of the returns, i.e. winners will keep on winning and losers loosing, than the average return of the sample.

Figure 17 presents the monthly returns of the REIT momentum strategy during the eight worst months of the REIT long-only strategy. The figure highlights the fact that REIT momentum and REIT long-only strategies are at least somewhat correlated. Of the eight months studied, there are only two months during which REIT momentum strategy provides good returns. In addition in four months the REIT momentum strategy provides negative returns and in two months the returns are only slightly positive, i.e. this is evidence that the REIT momentum

strategy doesn't provide investors with good diversification benefits for the REIT long-only strategy.

**Figure 17: Performance of REIT momentum in the 8 worst months of REIT long-only**
The figure presents REIT long-only and REIT momentum strategy's monthly performance during the 8 single worst months of the S&P 500 stock index during the period of 1995 – 2007. REIT momentum refers to 10/10 (B) R6H6 REIT momentum strategy which has cut-off points in top and bottom 10%, 6 month ranking and holding periods and the effects of the bid-ask bounce has been taken into account.




The presented analysis gives evidence that REIT long-only and REIT momentum strategies can provide investors with risk return enhancement when the strategies are added to the a mixed-asset portfolio. First of all both strategies have low correlation between the equity and bond indices. Second, the correlation has remained low throughout the sample period. Third, REIT momentum and REIT long-only strategies provide good returns to investors when there is general stock market downturn or a recession. Finally, evidence indicates that REIT long-only and REIT momentum strategies are at least somewhat correlated, i.e. REIT momentum cannot provide investors with good returns during the months in which REIT long-only strategy has had bad performance.

# 6 Conclusions

In this thesis I have analyzed the tactical investing related to U.S. Real Estate Investment Trusts, i.e. momentum phenomenon and the diversification benefits of REIT momentum and REIT long-only strategies. I utilize the overlapping portfolio methodology of Jegadeesh and Titman (1993) when calculating the momentum returns. In addition, I use all of the commonly used specifications of momentum portfolio construction, i.e. 3, 6, 9 and 12 month ranking and holding periods and also 10%, 20% and 30% as the cut-off points when constructing the winner and loser portfolios. This leads to a total of 96 different individual momentum strategies. In addition, I also test the Hong et al. (1999) information diffusion theory as a potential explanation of momentum profits by examining the magnitude of the momentum profits in two uniquely different states of the market. I also study to what extent the momentum profits are explained by the Fama and French (1993) three risk factors, by utilizing the Fama and French (1993) three factor model. In order to both test the robustness of momentum profits and in addition find evidence of the practical feasibility of REIT momentum strategies, I test the effect of transaction costs to the momentum profits and also estimate the potential size of momentum position which an institutional investor could trade. I also study the REITs which appear in the momentum portfolios most often in detail and try to find out whether these REITs have common characteristics. Finally, I also study the diversification benefits of both REIT momentum and REIT long-only strategies in both recession and general stock market downturn.

The main finding of this thesis is that first of all, strong evidence indicates that the momentum phenomenon exist also in the REIT market. All of the 96 different individual momentum strategies studied showed positive average monthly excess returns. Also evidence indicates that the strategies which have longer ranking periods and shorter holding periods provide the best returns. Reasons behind the dominance of shorter holding periods could be that REIT momentum might experience reversals in the longer holding periods, thus decreasing the excess returns. The reason for the dominance of the longer ranking periods could be that REITs experience shorter term fluctuation and in order for the REITs which experience return continuation, i.e. momentum to be selected to the momentum portfolio one needs to use longer ranking periods. However, evidence also indicates that in practise the REIT momentum strategies aren't feasible for an institutional investor, i.e. a hedge fund could not make profit by trading only REIT momentum strategies. The implementation of the

transaction costs critically decreases the momentum returns, thus in practise the returns wouldn't probably exist. Also the estimation of the REIT momentum position sizes presents evidence that positions which a single investor could trade by using REIT momentum strategies are too small for institutional investors. In addition, strong evidence indicates that the momentum excess returns aren't caused by the Fama and French three risk factors, i.e. the Fama and French (1993) three factor model is unable to explain the momentum returns. Also during the subperiod in which speed of information diffusion in REITs is slower the momentum phenomenon is stronger, this finding supports the Hong et al. (1999) information diffusion theory as a potential explanation of momentum profits. I also find that there are common characteristics for momentum REITs, they are i) smaller, ii) have smaller institutional ownership iii) have more leverage and more fluctuating earnings per share than REITs on average in the sample. Finally evidence indicates that both REIT momentum and REIT long-only strategies can provide investors with diversification benefits in a mixed-asset portfolio situation. This enhancement is attainable both in the recession and in the general stock market downturn. Table 18 presents the summary of the hypothesis of this study along with used methodology and main findings related to the hypothesis.

**Table 18: Summary of the main findings of tactical investing in U.S. REITs**

| Hypothesis | Methodology | Key findings |
|---|---|---|
| **H1.** There are positive momentum returns in REIT stocks when transaction costs are excluded. | Momentum model: 96 different individual momentum strategies. | **Strong support.** All of the 96 individual strategies show average monthly excess returns. |
| **H2.** The momentum returns are stronger in the first subperiod 1.1.1995 - 31.12.2001. | Momentum model: 96 individual strategies divided into two subperiods. Comparison of the 192 strategies from two subperiods. | **Strong support.** In majority of cases the momentum returns are stronger in the first subperiod. |
| **H3.** The success of momentum strategies are not caused by Fama and French (1993) three risk factors. | Explaining the momentum returns by the Fama French (1993) three factor model. | **Strong support.** The model is unable to explain the momentum returns. Positive and statistically significant alpha is found from almost all of the 96 strategies. |
| **H4.** Momentum profits disappear when transaction costs are taken into account. | Implementation of a custom made transaction cost model to the momentum profits in 10/10 (B) momentum strategies. (16 individual strategies in total) | **Semi strong support**. Momentum profits loose their statistical significance even with conservative transaction cost estimates and vanish completely with realistic cost assumptions. |
| **H5.** Reit momentum positions are too small for institutional investors. | Implemention of a custom made trading volume estimation model to the 10/10 (B) R6H6, 20/20 (B) R6H6 and 30/30 (B) R6H6 momentum strategies. | **Semi Strong support.** Average monthly REIT momentum positions in between $23 815 - $380 702 during the whole sample period. |
| **H6.** Adding REIT momentum and REIT long-only strategies to a mixed asset portfolio. | Analysis of REIT long only and REIT momentum strategies performance in different states of the market. | **Semi strong support.** REIT long-only and REIT momentum strategies have low correlation with stock and bond indices. Also the strategies show good performance both during recession and general stock market downturn. |

The main findings of this thesis first of all confirm the results attained in the previous literature, e.g. Jegadeesh and Titman (1993 and 2001), Moskowitz and Grinblatt (1999) and Hong et al. (2000) have documented the momentum phenomenon in the general stock market and Chui et al. (2003a and 2003b) and Glascock et al. (2003) in Real Estate Investment Trust market. However, the evidence presented in this thesis argues that in practise the REIT momentum strategies cannot be used to make money by an institutional investor. The transaction costs critically diminish the excess returns and also the position size estimation provides evidence that in practise the REIT momentum positions would be to small for an institutional investor to trade. In addition, this thesis finds evidence which supports the Hong et al. (1999) information diffusion theory as possible explanation of momentum profits. This finding is an interesting one as the theory argues that momentum returns are bigger in the time periods when speed of information diffusion is slower. Intuitively thinking this sounds reasonable, and according to the results of this thesis this theory seems to have some explaining power. The finding that the REIT momentum profits cannot be explained by the Fama and French (1993) three factor model are in line with the current literature as e.g. Fama and French (1996) have similar results from the general stock market. The findings regarding the so called "momentum REITs", i.e. the REITs which appear in the momentum portfolio most often are in line with intuition. They clearly are more risky, in terms of leverage and more volatile earnings per share, which makes sense when thinking that the momentum strategies focus on REITs which are either top or bottom performers, thus implicitly more risky than the average REIT. Finally, the evidence regarding the diversification benefits of both REIT momentum and REIT long-only strategies are in line with previous literature, e.g. Lee et al. (2005) find evidence that REITs can enhance the performance of mixed-asset portfolio, thus offer diversification benefits to investors.

Finally, this thesis argues that after these findings and especially the ones related to transaction costs and potential REIT momentum position sizes, the REIT momentum literature should be observed in a new way. Momentum phenomenon exists in the market, if it cannot be exploited in practise but only on paper. In this case the arbitrageurs cannot exploit the REIT momentum phenomenon, thus it seems that it exist in the market when actually in practise it doesn't exist. Due to this finding this thesis presents a new question to the field of REIT momentum research: if momentum profits exist on scientific research which is simplified but cannot be exploited in a real life situation do the momentum phenomena still exist? It is the same kind of question as the classical: "*If a tree falls down in a wood, and*

*nobody witnesses it, does it make a sound*?" Naturally the answer to both of these questions can be debated forever as there are always arguments and counter arguments for each side. The author leaves the final answer to reader's own interpretation.

*Directions for future research*

This thesis raises important questions for future research. The first is related to further empirical examination of the overall feasibility of momentum strategies. Many studies, this one included, have documented the momentum phenomenon but this study is the first attempt to seriously evaluate the practical feasibility of momentum strategies, i.e. could they be used in a real life setting in order to make money. Therefore, it would be of great interest to further study this issue in more detail, and also expand it to the general stock market momentum literature, i.e. could general stock market momentum strategies be used in real life situation by a hedge fund to make money. Drivers which I think should be included to that kind of research are at least rigorous estimation on effect of transaction costs on momentum profits and the potential position sizes which could be traded by using different momentum strategies in the general stock market. In addition, it would be interesting to further study the different behavioural theories' effectiveness in explaining the momentum profits as currently the results concerning them are mixed.

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Appendix 1: Alphabetical list of REITs used in the study

| Company | Ticker | RIC | Description |
|---|---|---|---|
| Acadia Realty Trust | AKR-N | AKR.N | Retail REIT |
| Agree Realty Corp | ADC-N | ADC.N | Retail REIT |
| Alexander's Inc | ALX-N | ALX.N | Retail REIT |
| Alexandria Real Estate Equities Inc | ARE-N | ARE.N | Office REIT |
| AMB Property Corp | AMB-N | AMB.N | Industrial REIT |
| American Campus Communities Inc | ACC-N | ACC.N | Residential REIT |
| American Financial Realty Trust | AFR-N | AFR.N | Office REIT |
| American Land Lease Inc | ANL-N | ANL.N | Residential REIT |
| American Mortgage Acceptance Co | AMC-A | AMC.A | Mortgage REIT |
| AmREIT | AMY-A | AMY.A | Retail REIT |
| Annaly Capital Management Inc | NLY-N | NLY.N | Mortgage REIT |
| Anthracite Capital Inc | AHR-N | AHR.N | Mortgage REIT |
| Anworth Mortgage Asset Corp | ANH-N | ANH.N | Mortgage REIT |
| Apartment Investment and Management Co | AIV-N | AIV.N | Residential REIT |
| Arbor Realty Trust Inc | ABR-N | ABR.N | Mortgage REIT |
| Arizona Land Income Corp | AZL-A | AZL.A | Mortgage REIT |
| Ashford Hospitality Trust Inc | AHT-N | AHT.N | Specialised REIT |
| Associated Estates Realty Corp | AEC-N | AEC.N | Residential REIT |
| AvalonBay Communities Inc | AVB-N | AVB.N | Residential REIT |
| Berkshire Income Realty Inc | BIR.A-A | BIR_pa.A | N/A |
| BioMed Realty Trust Inc | BMR-N | BMR.N | Office REIT |
| Boston Properties Inc | BXP-N | BXP.N | Office REIT |
| BRE Properties Inc | BRE-N | BRE.N | Residential REIT |
| Camden Property Trust | CPT-N | CPT.N | Residential REIT |
| Capital Alliance Income Trust Ltd | CAA-A | CAA.A | Mortgage REIT |
| Capital Trust Inc | CT-N | CT.N | Mortgage REIT |
| CapitalSource Inc | CSE-N | CSE.N | Mortgage REIT |
| CapLease Inc | LSE-N | LSE.N | Diversified REIT |
| Capstead Mortgage Corp | CMO-N | CMO.N | Mortgage REIT |
| Care Investment Trust Inc | CRE-N | CRE.N | Mortgage REIT |
| CBL & Associates Properties Inc | CBL-N | CBL.N | Retail REIT |
| CBRE Realty Finance Inc | CBF-N | CBF.N | Mortgage REIT |
| Cedar Shopping Centers Inc | CDR-N | CDR.N | Retail REIT |
| Cogdell Spencer Inc | CSA-N | CSA.N | Specialised REIT |
| Colonial Properties Trust | CLP-N | CLP.N | Diversified REIT |
| Corporate Office Properties Trust | OFC-N | OFC.N | Office REIT |
| Cousins Properties Inc | CUZ-N | CUZ.N | Diversified REIT |
| Crystal River Capital Inc | CRZ-N | CRZ.N | Mortgage REIT |
| DCT Industrial Trust Inc | DCT-N | DCT.N | Industrial REIT |
| Deerfield Triarc Capital Corp | DFR-N | DFR.N | Mortgage REIT |
| Developers Diversified Realty Corp | DDR-N | DDR.N | Retail REIT |
| DiamondRock Hospitality Co | DRH-N | DRH.N | Specialised REIT |
| Digital Realty Trust Inc | DLR-N | DLR.N | Office REIT |
| Douglas Emmett Inc | DEI-N | DEI.N | Office REIT |
| Duke Realty Corp | DRE-N | DRE.N | Office REIT |
| DuPont Fabros Technology Inc | DFT-N | DFT.N | Industrial REIT |
| EastGroup Properties Inc | EGP-N | EGP.N | Industrial REIT |
| Education Realty Trust Inc | EDR-N | EDR.N | Residential REIT |
| Entertainment Properties Trust | EPR-N | EPR.N | Specialised REIT |
| Equity Lifestyle Properties Inc | ELS-N | ELS.N | Residential REIT |
| Equity One Inc | EQY-N | EQY.N | Retail REIT |
| Equity Residential | EQR-N | EQR.N | Residential REIT |
| Essex Property Trust Inc | ESS-N | ESS.N | Residential REIT |
| Extra Space Storage Inc | EXR-N | EXR.N | Specialised REIT |
| Federal Realty Investment Trust | FRT-N | FRT.N | Retail REIT |
| Felcor Lodging Trust Inc | FCH-N | FCH.N | Specialised REIT |
| Feldman Mall Properties Inc | FMP-N | FMP.N | Retail REIT |
| First Industrial Realty Trust Inc | FR-N | FR.N | Industrial REIT |
| First Potomac Realty Trust | FPO-N | FPO.N | Industrial REIT |
| Franklin Street Properties Corp | FSP-A | FSP.A | Office REIT |
| Friedman Billings Ramsey Group Inc | FBR-N | FBR.N | Mortgage REIT |
| General Growth Properties Inc | GGP-N | GGP.N | Retail REIT |
| Getty Realty Corp | GTY-N | GTY.N | Retail REIT |
| Gladstone Commercial Corp | GOOD-O | GOOD.O | Diversified REIT |
| Glimcher Realty Trust | GRT-N | GRT.N | Retail REIT |
| GMH Communities Trust | GCT-N | GCT.N | Residential REIT |
| Gramercy Capital Corp | GKK-N | GKK.N | Mortgage REIT |
| Hanover Capital Mortgage Holdings Inc | HCM-A | HCM.A | Mortgage REIT |
| HCP Inc | HCP-N | HCP.N | Specialised REIT |
| Health Care REIT Inc | HCN-N | HCN.N | Specialised REIT |
| Hersha Hospitality Trust | HT-A | HT.A | Specialised REIT |
| Highwoods Properties Inc | HIW-N | HIW.N | Office REIT |
| HMG/Courtland Properties Inc | HMG-A | HMG.A | Retail REIT |

| Company | Ticker | RIC | Description |
|---|---|---|---|
| Home Properties Inc | HME-N | HME.N | Residential REIT |
| Hospitality Properties Trust | HPT-N | HPT.N | Specialised REIT |
| Host Hotels & Resorts Inc | HST-N | HST.N | Specialised REIT |
| HRPT Properties Trust | HRP-N | HRP.N | Office REIT |
| Impac Mortgage Holdings Inc | IMH-N | IMH.N | Mortgage REIT |
| Inland Real Estate Corp | IRC-N | IRC.N | Retail REIT |
| Investors Real Estate Trust | IRETS-O | IRETS.O | Diversified REIT |
| iStar Financial Inc | SFI-N | SFI.N | Mortgage REIT |
| JER Investors Trust Inc | JRT-N | JRT.N | Mortgage REIT |
| Kilroy Realty Corp | KRC-N | KRC.N | Office REIT |
| Kimco Realty Corp | KIM-N | KIM.N | Retail REIT |
| Kite Realty Group Trust | KRG-N | KRG.N | Retail REIT |
| LaSalle Hotel Properties | LHO-N | LHO.N | Specialised REIT |
| Lexington Realty Trust | LXP-N | LXP.N | Office REIT |
| Liberty Property Trust | LRY-N | LRY.N | Diversified REIT |
| LTC Properties Inc | LTC-N | LTC.N | Specialised REIT |
| Luminent Mortgage Capital Inc | LUM-N | LUM.N | Mortgage REIT |
| Macerich Co | MAC-N | MAC.N | Retail REIT |
| Mack-Cali Realty Corp | CLI-N | CLI.N | Office REIT |
| Maguire Properties Inc | MPG-N | MPG.N | Office REIT |
| Maxus Realty Trust Inc | MRTI-O | MRTI.O | Residential REIT |
| Medical Properties Trust Inc | MPW-N | MPW.N | Specialised REIT |
| MFA Mortgage Investments Inc | MFA-N | MFA.N | Mortgage REIT |
| Mission West Properties Inc | MSW-A | MSW.A | Office REIT |
| Monmouth Real Estate Investment Corp | MNRTA-O | MNRTA.O | Industrial REIT |
| National Health Investors Inc | NHI-N | NHI.N | Specialised REIT |
| National Retail Properties Inc | NNN-N | NNN.N | Retail REIT |
| Nationwide Health Properties Inc | NHP-N | NHP.N | Specialised REIT |
| Newcastle Investment Corp | NCT-N | NCT.N | Mortgage REIT |
| NorthStar Realty Finance Corp | NRF-N | NRF.N | Mortgage REIT |
| Omega Healthcare Investors Inc | OHI-N | OHI.N | Specialised REIT |
| One Liberty Properties Inc | OLP-N | OLP.N | Diversified REIT |
| Origen Financial Inc | ORGN-O | ORGN.O | Mortgage REIT |
| Parkway Properties Inc | PKY-N | PKY.N | Office REIT |
| Pennsylvania Real Estate Investment Trust | PEI-N | PEI.N | Retail REIT |
| Pittsburgh & West Virginia Railroad | PW-A | PW.A | Specialised REIT |
| Plum Creek Timber Co Inc | PCL-N | PCL.N | Specialised REIT |
| PMC Commercial Trust | PCC-A | PCC.A | Mortgage REIT |
| Post Properties Inc | PPS-N | PPS.N | Residential REIT |
| Potlatch Corp (Holding Co) | PCH-N | PCH.N | Specialised REIT |
| Presidential Realty Corp | PDL'A-A | PDLa.A | Diversified REIT |
| Prime Group Realty Trust | PGE.B-N | PGE_pb.N | Office REIT |
| ProLogis | PLD-N | PLD.N | Industrial REIT |
| PS Business Parks Inc | PSB-A | PSB.A | Diversified REIT |
| Public Storage | PSA-N | PSA.N | Specialised REIT |
| RAIT Financial Trust | RAS-N | RAS.N | Mortgage REIT |
| Ramco-Gershenson Properties Trust | RPT-N | RPT.N | Retail REIT |
| Rayonier Inc | RYN-N | RYN.N | Specialised REIT |
| Realty Income Corp | O-N | O.N | Retail REIT |
| Redwood Trust Inc | RWT-N | RWT.N | Mortgage REIT |
| Regency Centers Corp | REG-N | REG.N | Retail REIT |
| Resource Capital Corp | RSO-N | RSO.N | Mortgage REIT |
| Roberts Realty Investors Inc | RPI-A | RPI.A | Residential REIT |
| Saul Centers Inc | BFS-N | BFS.N | Retail REIT |
| Senior Housing Properties Trust | SNH-N | SNH.N | Specialised REIT |
| Simon Property Group Inc | SPG-N | SPG.N | Retail REIT |
| SL Green Realty Corp | SLG-N | SLG.N | Office REIT |
| Sovran Self Storage Inc | SSS-N | SSS.N | Specialised REIT |
| Strategic Hotels & Resorts Inc | BEE-N | BEE.N | Specialised REIT |
| Sun Communities Inc | SUI-N | SUI.N | Residential REIT |
| Supertel Hospitality Inc | SPPR-O | SPPR.O | Specialised REIT |
| Tanger Factory Outlet Centers Inc | SKT-N | SKT.N | Retail REIT |
| Thomas Properties Group Inc | TPGI-O | TPGI.O | Real Estate MNGT&development |
| Thornburg Mortgage Inc | TMA-N | TMA.N | Mortgage REIT |
| UDR Inc | UDR-N | UDR.N | Residential REIT |
| UMH Properties Inc | UMH-A | UMH.A | Residential REIT |
| Urstadt Biddle Properties Inc | UBP-N | UBP.N | Retail REIT |
| U-Store-It Trust | YSI-N | YSI.N | Specialised REIT |
| Washington Real Estate Investment Trust | WRE-N | WRE.N | Diversified REIT |
| Weingarten Realty Investors | WRI-N | WRI.N | Retail REIT |
| Ventas Inc | VTR-N | VTR.N | Specialised REIT |
| Winthrop Realty Trust | FUR-N | FUR.N | Diversified REIT |
| Vornado Realty Trust | VNO-N | VNO.N | Diversified REIT |